74327

No. 1253
Complete T-KIT with Enclosure

9-BAND SHORTWAVE RECEIVER

Electronic switching of 9 bands in 1.8-22MHz range, with front panel RF gain and fine tuning; plus outstanding speaker/headphone audio

T-KIT
by TEN-TEC

INSTRUCTION MANUAL

America's Best!

Kit Assembly and Instruction Manual
for T-KIT Model No. 1253

9-Band Shortwave Receiver

IMPORTANT: Please read Warranty Terms BEFORE starting kit assembly.

. . . A quality electronics kit project from
T-KIT

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Introduction

The T-KIT 1253 receiver features electronic switching among the most popular international broadcasting and ham bands between 1.8 and 22 MHz. Far more "deluxe" than most simple kit-built receivers, it has ample audio power for a built-in speaker, convenient front panel controls, and a top quality cabinet.

The T-KIT 1253 continues the tradition of inexpensive shortwave radio kits which began as a phenomenon of the Depression years before World War II. Many a career in electronics has been launched by the first thrill of building one's own radio set that could pick up signals from around the world. You're about to build and enjoy a practical shortwave receiver which employs a circuit concept as old as the 1920's but which uses modern engineering that takes advantage of the advanced capabilities of today's electronic components and circuit design.

Our goal was to design the very best multi-band shortwave radio kit for AM-SSB-CW reception in its price class. We live now in an age where that kind of money can buy very sophisticated major-brand electronics gadgets, including stereos, cordless phones, music keyboards and even portable shortwave radios (without CW-SSB reception capability). We have come to expect quite a lot from our "consumer electronics" dollar, because today's electronic technology is marvelous indeed.

Even if you have never worked with electronic parts before, you can successfully build this receiver by carefully following all the directions in this book. Step by step, we'll show you how to build it and how to enjoy it.

One purpose of your receiver and the details provided in this instruction manual is to help you become better acquainted with radio communications and electronics . . as a hobby, as a possible profession, or both. As a matter of fact, this receiver design incorporates many if not most of the basic circuit building blocks used in all communications equipment:

- ✔ RF amplifier
- ✔ RF oscillator
- ✔ Varactor tuning
- ✔ Resonant L-C circuits
- ✔ Buffer-amplifier
- ✔ Audio preamplifier
- ✔ Integrated audio amplifier
- ✔ Integrated voltage regulator
- ✔ Digital logic IC

So, the better you understand how this receiver works, the more you learn about modern electronics!

"Regenerative" Receivers: THE STORY . . .

The "regenerative receiver" moved the world of radio reception and broadcasting beyond the limits of crystal sets useful only for hearing a strong local signal. For over a decade, these magical, whistling, squawking, glowing boxes were the norm for home listening as well as for the first generation of radio hams.

Receiver design evolved swiftly. The "superheterodyne" became the norm during the 1930's. Regenerative receivers, often called "Gennies," were left to tinkerers and beginners. Even though these receivers were simple and quite sensitive, they had a number of shortcomings: instability, touchiness, difficulty in separating strong stations, a tendency to generate interference to other receivers, and a general reputation for making odd sounds that resembled everything from birds to motorboats.

However, the sheer SIMPLENESS of the regenerative circuit remained attractive to experimenters and beginners. ln fact, as recently as the 1960's, one company marketed a $ 14 kit for building a complete transceiver using only one vacuum tube: half of the tube served as a regenerative receiver, and the other half was a low-power crystal-controlled transmitter. In addition, many thousands of engineering careers as well as ham radio licenses were launched with the building of "my first shortwave radio" from do-it-yourself regenerative receiver kits offered by the major radio companies of several decades ago. (The fondest daydream back then of most of these radio builders was to be ab[e to afford to move up to a "superhet communications receiver." Their fondest memory TODAY is that very first receiver kit!)

From the late 1970's through the '80's, as consumer electronics and new ham radio equipment became more sophisticated so very rapidly, interest declined not only in regenerative receivers, but-also in kit-building and even in shortwave radio listening. One or two generations of Americans simply missed out on the thrill and satisfaction of building and understanding a simple radio set which could receive signals from around the world.

Today, both shortwave radio listening and building electronic kits are again popular pastimes. Your T-KIT 1253 is a much better receiver than the "classic" radio sets which attracted several

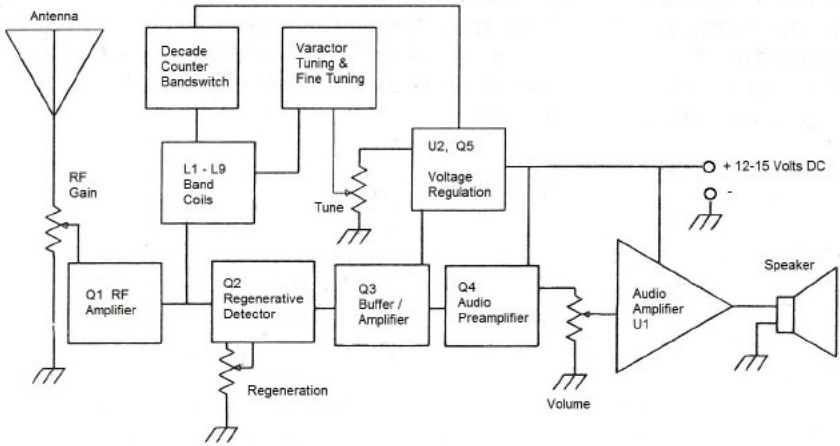
generations of Americans to the excitement of radio and electronics. In fact, its basic performance is superior to many of the simplest superhet receivers which were considered such a great step beyond one's first regenerative set'

The reason why this receiver works so well is because there is much more precision in today's engineering designs and the manufacturing of electronic parts. we looked carefully at the practical problems associated with yesteryear's technology and used **today's** know-how and components to minimize those problems. The push-button bandswitching is made possible by an IC (integrated circuit) designed for computer circuits. The generous speaker volume is made possible by an IC designed for car stereos. The simplicity of the multi-band coverage is made possible by tiny molded coils (L1 to L9). The frequency stability, quite a problem in older designs, is the result of the voltage regulator IC and the fairly cool operating temperature of all the components. And, even though air-variable tuning capacitors have become quite expensive these days, smooth main tuning and fine tuning controls are made possible by "varactor diode" technology.

How It Works:
An Introductory Circuit Description

A somewhat more technical explanation of your receiver is in the Notes for Ham Club Leaders appendix. In the meantime, you can follow the block diagram below, peek at the schematic diagram which is the centerfold of this manual, the "glossary" of Helpful Words and Abbreviations (pp. 13-14), and the following circuit explanation.

T-KIT Model No. 1253 Regenerative Receiver
Block Diagram
(A block diagram illustrates how major circuit sections are connected together without showing all individual components as does the "schematic" diagram.)



To say it simply, a "detector" converts radio energy from an antenna into audio energy, i.e., a sound which you can hear. A detector can be as simple as a crystal diode, which is the heart of the simple "crystal radio." If you've ever heard unwanted radio signals on a stereo, telephone, PA system or intercom, you can assume that some part of those devices has acted as a detector to convert a nearby CB, taxi or broadcast signal into intelligible sound. (This process of detection is also referred to as demodulation.)

In the following explanation, the words regeneration, feedback and oscillation all mean approximately the same thing.

By itself, a detector can interpret or demodulate only very strong signals such as a nearby AM radio station. However, the process of regeneration can make a simple detector much more sensitive by turning the detector into an "oscillating amplifier." The regeneration circuit repeatedly feeds the detected signal back to the input which boosts its strength many hundreds of times. This feedback process must be carefully adjusted, which is the important function of the regeneration control.

This receiver consists of an RF amplifier (Q11, a "regenerative" detector/oscillator (Q2,Q3), an audio preamplifier (Q4), and an integrated circuit audio amplifier (U1). Integrated circuit U2 is a voltage regulator supplying a stable 8.0 volts to all circuits except Q4 and U1. Transistor Q5 provides additional voltage regulation for the varactor tuning circuit controlled by D10 and for the detector/oscillator circuit.

Band switching is accomplished by the CD74HC4017 IC, a TTL "decade counter" used in numerous digital logic circuits. It is wired so that pressing the push button provides the "clock pulse" needed to advance or "count" to the next output. The voltage from a given output pin lights the corresponding LED and powers the Q1/Q2 circuitry through the inductor selected. Diodes D1-D9 are "PIN" diodes which pass DC voltage through the band-selection inductors (L1-L9) while also stopping the RF energy of Q1/Q2 from interfering with or being absorbed by the switching circuit and power supply circuitry.

The frequency of oscillation is determined by the choice of inductors (bandswitch), any capacitors used for C34-C42, and the setting of the tuning controls. If the oscillator is tuned to 7 MHz, for example, any radio signal on that frequency will be boosted and detected in the regeneration process. The resulting output from transistor Q3 is a low-level audio signal which is boosted by Q4 and further amplified to speaker level by the TDA261 1A IC ("integrated circuit") amplifier.

The RF amplifier (Q1) serves two purposes. It boosts the RF signals from the antenna to the detector, and it minimizes the amount of oscillator RF going back out to the antenna.

Diodes D11 and D12 permit the use of an external DC power supply with no need to remove the batteries.

IMPORTANT:
Battery and DC Power Supply Requirements

The receiver is designed to operate on 12 volts DC from 8 "C" cells mounted internally or from an external 12-15 volts DC power source. The external supply may be a vehicle, marine or motorcycle battery, or a well-filtered DC supply plugged into an AC outlet. Some "wall transformer" power supplies may also be suitable as detailed below.

1. Install the SAME TYPE of "C" cells in ALL 8 positions. In particular, NEVER mix alkaline batteries with other types, because there is a serious hazard of a cell bursting.

2. If the receiver is to be in storage for a while, remove the batteries to prevent leakage.

3. Weak batteries affect the tuning characteristics of the receiver as well as volume.

4. To conserve battery life, always turn the receiver OFF when not in use.

5. The external DC connection is NOT a battery charging circuit.

6. The DC connector accepts a 2.1 mm I.D. by 5.0 mm O.D. coaxial DC power plug such as Radio Shack™ 274-1567. The center must be wired to +DC; the sleeve is -DC (ground).

7. "Wall adapter" power supplies vary widely in design and quality. If you hear a lot of AC hum or buzz, the supply has inadequate filtering for use with this receiver. Make certain that any such unit has DC output and is not merely a transformer (AC output). We tested the Radio Shack™ No. 273-1652 12VDC adapter with good results.

8. A 13.5 VDC "test bench" power supply, whether purchased or homebuilt, is a very practical accessory for experimenting with modern electronic circuits. Obsolete computers can be a good source for good-quality power supplies providing several DC voltages. Information and all parts needed for constructing simple power supplies can be found at Radio Shack™ stores, including the useful book Building Power Supplies: Useful Designs for Hobbyists and Technicians (No. 276-5025).

T-KIT 1253 Regenerative Receiver
KIT PARTS LIST

Please check and organize all parts before starting construction.
See T-KIT Warranty if you suspect any parts are missing.

Quantity		Description and Value	Schematic	Part No

Fixed Resistors

The 3 color bands denote resistance value. The 4th band (gold) denotes 5% tolerance.

2	❑	3.3 ohm (orange-orange-gold)	R18, R23	30109
1	❑	10 ohm(brown-black-black)	R3	30115
2	❑	100 ohm (brown-black-brown)	R28, R29	30126
1	❑	270 ohm (red-violet-brown)	R14	30131
2	❑	470 ohm (yellow-violet-brown)	R8, R16	30134
1	❑	560 ohm (green-blue-brown)	R26	30135
1	❑	680 (blue-gray-brown).....	R2	30136
2	❑	1K (brown-black-red)	R7, R10	30138
1	❑	1.5K {brown-green-red}	R25	30140
1	❑	3.3K (orange-orange-red)	R15	30144
2	❑	4.7K (yellow-violet-red)	R8, R11, R27	30146
3	❑	10K (brown-black-orange)	R9, R13, R19	30150
1	❑	22K (red-red-orange)	R24	30154
1	❑	47K (yellow-violet-orange)	R12	30157
2	❑	1 megohm (brown-black-green)	R4, R22	30173

Capacitors

1	❑	33 pF	C2	23376
1	❑	56 pF	C34	23379
2	❑	100 pF disc capacitor (marked 101)	C1, C13	23385
1	❑	220 pF disc capacitor (marked 221)	C18	23396
7	❑	.01 µF ceramic disc (marked 103)	C3, C4, C6,C7 C9, C19, C43	23260
9	❑	01 µF ceramic disc (marked 103)	C20-C28	23340
2	❑	.1 µF ceramic disc (marked 104)	C8, C15	23261
1	❑	.1 µF ceramic disc (marked 104)	C12	23328
3	❑	1 µF electrolytic	C5, C11, C31	23264
1	❑	10 µF electrolytic	C29	23266
2	❑	33 µF electrolytic	C14, C33	23308
2	❑	100 µF electrolytic	C30, C32	23189
1	❑	220 µF electrolytic	C17	23202
2	❑	470 µF electrolytic	C10, C16	23228

Inductors

1	❑	1.2 µH molded coil (brown-red-gold-gold)	L9	21113
1	❑	1.5 µH molded coil (brown-green-gold-gold)	L8	21114
1	❑	2.2 µH molded coil (red-red-gold-gold)	L7	21116
1	❑	3.3 µH molded coil (orange-orange-gold-gold)	L6	21118
1	❑	4.7 µH molded coil (yellow-violet-gold-gold)	L5	21120
1	❑	8.2 µH molded coil (gray-red-gold-gold)	L4	21123
1	❑	12 µH molded coil (brown-red-black-gold)	L3	21125
1	❑	33 µH molded coil (orange-orange-black-gold)	L2	21130
1	❑	68 µH molded coil (blue-gray-black-gold)	L1	21162
1	❑	100 uH RF Choke	L10	21060

Semiconductor Devices: Transistor, Diodes

2	❑	NPN transistor type 2N4124G	Q4, Q5	25258
3	❑	FET transistor type J310	Q1, Q2, Q3	25115
1	❑	Voltage regulator IC, type MC7805CT	U2	25095
1	❑	Audio amplifier IC, type TDA2611A	U1	25299
9	❑	PIN diode, type IN4148.....	D1-D9	28001
1	❑	Varactor diode, type MV209	D10	28050
2	❑	Rectifier diode, type 1N4002	D11, D12	28000
1	❑	LED (light-emitting diode)	LED1	28082

Other Components:

1	❑	Circuit Board for Model 1253.....	.....	78186
5	❑	10 K potentiometer	R1, 5, 17, 20, R21	30267
1	❑	100 K trimmer potentiometer (marked 104)	R6	30858
1	❑	1/4" stereo headphone/speaker jack	J1	35414
1	❑	Toggle switch	S1	32110
2	❑	"C" cell battery holder	.....	35283
1	❑	2.1 mm. C power jack	.....	35132
1	❑	3: round speaker	.....	47011
1	❑	T-KIT Model 1253 Instruction Manual	.....	74327

ELECTRONIC SWITCH BOARD KIT

1	❑	470 ohm resistor (yellow-violet-brown)	R1	30134
1	❑	1.5 K resistor (brown-green-red).....	R3	30140
1	❑	3.3 K resistor (orange-orange-red)	R2	30144
1	❑	.01 µF mylar film capacitor (marked 103)	C1	23340
1	❑	CD74HC4017 16-PIN dip IC	U1	25355
1	❑	5.1 volt zener diode	D1	28041
9	❑	LED (light-emitting diode)	LED1-LED9	28082
1	❑	Circuit Board		78110
1	❑	Momentary push button switch	SW1	32053
1	❑	100MF 6.3V.....		23267

Optional, Not Supplied:

16- pin DIP socket for U1

Wiring Supplies:

1	❑	Black hookup wire, 3.0 feet		46010
1	❑	Red hookup wire, 3.0 feet		46012
1	❑	White hookup wire, 7.5 feet		46019
1	❑	RG174 mini coax, 9 inches		46025
9	❑	Cable ties		77007
2	❑	9-volt battery snap connector		35174

1253 RECEIVER CABINET KIT, Finishing Hardware

1	❑	Model 1253 subpanel		93162
1	❑	Model 1253 chassis/panel		93159-DP2A
1	❑	Top shell		93157-CN
1	❑	Bottom shell		93158-CN
1	❑	Battery shelf		93160
1	❑	Speaker mounting plate		93161
2	❑	#10 solder lug		41011
4	❑	Rubber feet		42001
10	❑	#4 lock washer		51002
4	❑	#10 flat washer		51007
2	❑	#10 lock washer		51034
2	❑	#2 lock washer		51056
10	❑	#4-40 hex nut		54002
2	❑	#10 hex nut		54005
2	❑	#10 wingnut		54017
2	❑	#2-56 hex nut		54029
2	❑	1/4" #4-40 machine screw		60001
6	❑	3/8" #4-40 machine screw		60003
2	❑	1/2" #4-40 machine screw		60005
1	❑	1" #10 machine screw		60035
1	❑	1-1/4” #10 machine screw		60036
2	❑	#2-56 machine screw (to mount DC power connector)		60067
4	❑	#6 self-tapping screw (to secure cabinet shells)		59010
1	❑	Allen-type set screw (for main tuning knob)		65010
6	❑	#4-40 self-tapping screw		65028
4	❑	Control knob		81559
2	❑	Insulator (for Antenna terminal)		90681
1	❑	Switch button		92296-1
1	❑	Main tuning knob		93029
2	❑	Spacer		98077

Supplementary Parts Included (See Detail 3-44 in Phase 3 instructions):

1	❑	100 µH RF choke	L10	21060
1	❑	.01 µF disc capacitor	C43	23260

REQUIRED, not supplied:

- ❑ 8 fresh "C" Cells (alkaline or "heavy duty" recommended)
  OR: 12 volt DC power supply
- ❑ Antenna wire - 10-30 feet of hookup wire ("bell wire")
- ❑ Drop of clear glue (to secure DC power LED)
- ❑ Electrical tape (to insulate LED wires and battery snap connection.)
- ❑ Drop of water-based white paint (for groove of main tuning knob)
- ❑ Rosin-core solder (use THIN diameter solder intended for circuit boards)

RECOMMENDED (for hum-free reception on higher frequencies):

- ❑ Ground connection to rear panel (earth ground rod or copper cold water pipe).
  OR: coaxial feedline with grounded shield

OPTIONAL:

- ❑ Headphones or External Speaker
- ❑ Active antenna for portable operation (such as T-KIT 1552)
- ❑ Cigar lighter power cord for car/RV operation

MINIMUM TOOLS FOR 1253 KIT ASSEMBLY:

- ❑ 15 to 35 watt soldering iron
- ❑ diagonal cutters or wire "nippers"
- ❑ needle-nose pliers
- ❑ household pliers or nutdriver set (to tighten panel nuts)
- ❑ adjustable wire stripping tool
- ❑ miniature screwdriver or alignment blade (to adjust R6)
- ❑ small allen wrench set (for knob setscrews)
- ❑ 12" ruler (to measure hookup wire lengths)
- ❑ flat screwdriver or No. 4 nut driver (for #65028 screws)
- ❑ small and medium phillips screwdrivers

HELPFUL, SUGGESTED:

- ❑ VOM (multitester), digital or analog
- ❑ small nutdriver or socket set
- ❑ miniature alligator clip jumper wires

USE ROSIN-CORE SOLDER ONLY.
of a type intended for electronic PC-board assembly.
(Available at electronics distributors or Radio Shack™ stores.)
DO NOT use hardware store solder, paste or flux.
Solder contains LEAD: wash hands before eating!

Some Helpful Words & Abbreviations

We use plain English as much as possible, but there's no way around using common electronics terms and abbreviations where appropriate. We simply try to avoid "jargon" that is unnecessary. The following mini-glossary was compiled as a help to beginners working on THIS kit. These descriptions are NOT intended to be complete definitions.

Alignment ► One-time internal adjustment in a radio circuit. (See also: Trimmer)
AM ► Amplitude Modulation
Band ► a related group of frequencies
Board ► short for "printed circuit board," "PC board," or circuit board.
Bridge, Solder ► the unintentional joining of two 0r more points on the solder-side of a printed circuit board.
Carrier ► the inaudible signal that is the foundation of an AM or FM voice signal. In most AM or FM radios, the carrier is not heard, because regeneration 0r a BF() or direct-conversion is required to convert the carrier energy into an audible tone.
Cold (solder joint) ► A defective solder connection resulting from using too little heat. The joint looks like a ball and is not shiny.
CW, Continuous Wave ► refers to Morse Code signals
DC ► direct current (e.g. battery voltage in contrast to household AC wall outlet.)
Detector ► the section of any radio that changes radio energy into audio energy intended for listening.
Direct Conversion ► a popular type of simple receiver for CW-SSB which needs no regeneration control but which does not permit pleasant listening to AM shortwave broadcasts, because the carrier (see above) as well as the voice modulation can be heard. Example: T-KIT No. 1056.
Electrolytic (capacitor) ► a capacitor containing an acid or salt paste (electrolytic) and is generally polarized with a positive and negative side. Correct polarity MUST be observed when installing electrolytic capacitors.
FET or JFET ► "Field Effect Transistor"
Ground ► Refers to all points and surfaces in an electronic device which are connected to the -DG side of the power supply or battery. A "ground plane" of a circuit board is the large area of copper plating that is common to ground. "Earth ground" refers to water pipes or metal rods in direct contact with Mother Earth!
IC, Integrated Circuit ► A tiny plastic rectangular block with 3, 6, 8, 14 or more pins, containing a silicon "chip" which provides the equivalent of dozens or hundreds of individual transistors and resistors.
Inductor ► A coil or loop of wire used in electronic circuits
K ► abbreviation for 1000 ohms. (10K - 10,000 ohms).
kHz ► KiloHertz (1000 Hertz or cycles per second)
MHz ► MegaHertz (one million Hertz)
megohm ► one million ohms
µF► "microfarad," the usual unit of capacitance (1 X 10^{-6} Farad).
µH ► "microhenry" a common unit of inductance (1 X 10^{-6} Henry)
Oscillator ► see Regeneration
pf ► "picofarad," a tiny unit of capacitance (1 X 10^{-12} Farad).
Pad ► a circle or other shape around a circuit board hole for a solder connection.

Potentiometer, "pot" ► a variable resistor (see also Trimmer).
Regeneration, Regenerative ► a method of boosting the performance of a simple detector by feeding the detected signal back to the the input of the detector for further amplifying. This oscillation process must be adjusted carefully by using a regeneration potentiometer control.
RF ►radio Frequency energy, in contrast to audio or DC.
RTTY ► "Radio Teletype"
Superhet, superheterodyne ► **t**he most common type of receiver, in which the incoming signal is converted one or more times to other "intermediate" frequencies before being amplified. Proper operation requires more "alignment" (see above) than is usually practical for beginners.
SSB, Single Sideband ► a method of voice transmission which eliminates the carrier (whistle) which you hear in an AM broadcast if the Regeneration control is turned too far to the right.
Tin (in soldering) ►To coat a wire, cable shield or other surface with a thin coating of solder in order to make future soldering easier.
Tolerance ► **t**he manufacturing accuracy for electronic {and other} parts. Tolerance ranges from 20% down to better than 1% of the value marked on the part.
Trimmer ► a miniaturized variable resistor or capacitor used for occasional circuit adjustments.
Varactor, varactor diode ► a diode whose capacitance can be decreased in step with how much DC voltage is applied to it, therefore performing the same tuning function as an air-variable capacitor.
Vcc ► Voltage supplied to the collector of a transistor, roughly equivalent to "B+" in vacuum tube circuits. In general usage, Vcc refers to the main DC voltage in a circuit.

BEFORE You Start Building!

Your receiver is designed to work perfectly as soon as correct construction is completed. If you understand typical problems BEF0RE you build, chances are good that you won't make those classic errors which can frustrate electronic kit builders. There are just 4 possible mistakes which will cause your receiver not to work:

1. Installing a WRONG part.
Example: Using a 10 ohm resistor in place of 1 K (1,000 ohms) Or, using a resistor in place of a molded inductor.

2. Installing certain parts BACKWARDS.
Example: Reversing the (+) and (-) sides of an electrolytic capacitor, or pointing the flat side of a transistor in the wrong direction.

3. Faulty SOLDER connection.
Example: "cold" connections or solder "bridges"

4. OMITTING a part, solder connection or wire.
Example: if it's supposed to be there and isn't, we have a problem!

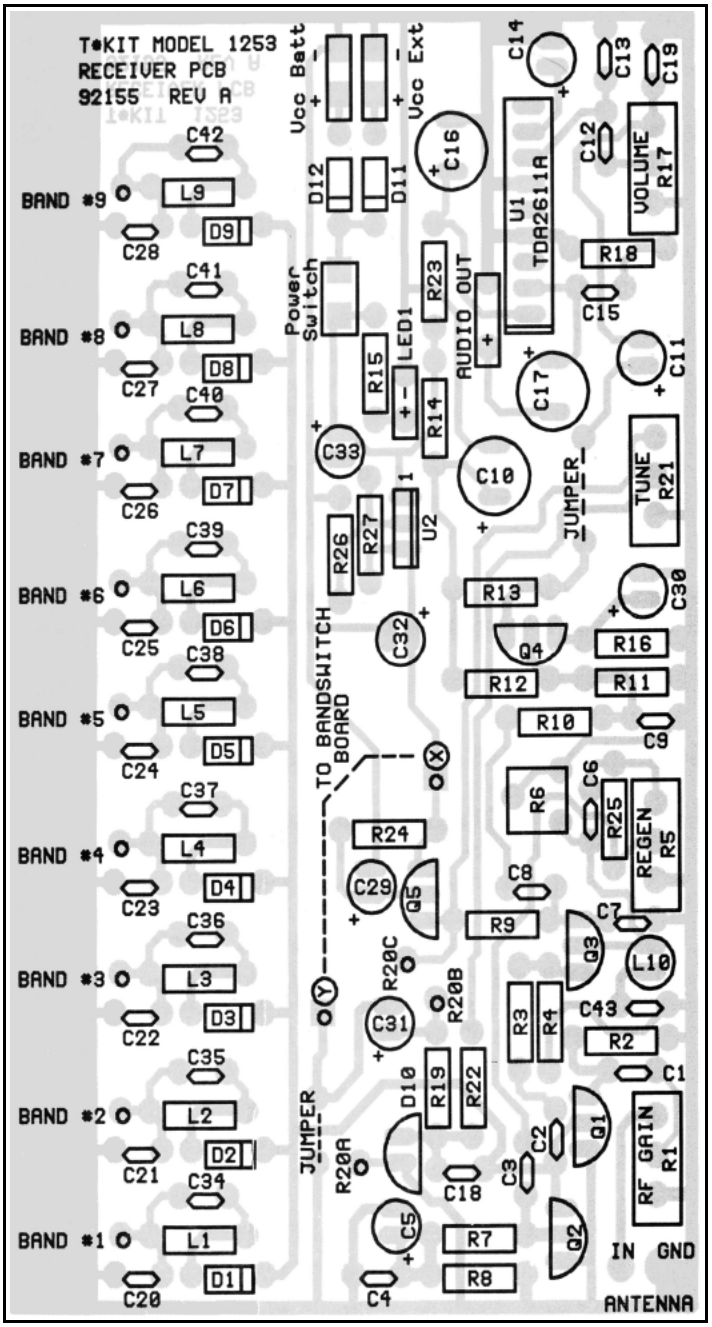
If a word or construction detail is unclear to you, check the glossary, or compare the imprinting on the board to the directions, or show it to a knowledgeable radio friend.

Installing Parts on the Circuit Board:

When we say **"INSTALL"** a part, we mean:

- ❑ Choose correct part value
- ❑ Insert in correct PC Board location
- ❑ Insert *correctly*, if there is a right way and wrong way such as for diodes, the audio IC, electrolytic capacitors, and transistors.
- ❑ Solder all wires or pins
- ❑ Trim or "nip" excess wire lengths

T-KIT Model 1253 Regenerative Receiver
X-RAY View of Main Circuit Board



Step-by-Step Receiver Kit Assembly

You will build the receiver in seven phases, testing the completed audio circuit (Q4 and U1) before doing the detector and tuning sections. The reason for this approach is that we want to make very sure that any whistles and beeps you hear from the receiver are real signals and not a malfunction of the amplifier section. Once you experience the amplifier section working properly, you can build the tuning/detector section with confidence and test basic receiver operation on one band before setting up the bandswitching system. Only after testing all functions will it be time to do final wiring and cabinet assembly.

Model 1253 Receiver Kit Assembly Phases:

- ❑ **Phase 1: Audio Amplifier Stages (Q4 and U1)**
- ❑ **Phase 2: DC Voltage Control and Regulation**
- ❑ **Phase 3: Regenerative Detector and Varactor Tuning**
- ❑ **Phase 4: Basic Receiver Operation Test**
- ❑ **Phase 5: Electronic Bandswitch Board**
- ❑ **Phase 6: Bandswitching components and wiring**
- ❑ **Phase 7: Final wiring and cabinet assembly**

We urge you to install all parts in the order specified in these step by step directions. However, some builders may find the following common questions and our answers helpful:

Q. I've built numerous kits. why can't I just install all parts as listed and try out the finished radio when I'm done? ➦ A. Like all T-KITs, the 1253 receiver indeed will work as specified if all parts are installed correctly. Our directions are intended to be as helpful as possible to beginners; please also see the final Q&A!

Q. Can I do this work in any other order than detailed in this manual? ➦ A. You can build the Bandswitch Board (Phase 5) anytime including right now. You can prepare the Main Tuning Knob anytime. You can mount the battery holders to the battery shelf anytime. otherwise, we think you'll find the sequence of this manual to make good sense.

Q. Must I complete a single step such as installing one resistor before starting the next one? ➦ A. There's certainly no harm in inserting several parts as one operation, soldering all points and trimming all wires and then checking off all of them at once in the blocks provided. Just remember that taking shortcuts can cause mistakes in any endeavor.

Q. I don't have a 12-volt DC power supply for those Progress Tests outlined in this manual. The cheapest one at Radio Shack™ is $30 what do I do? ➦ A. The very cheapest solution is to hook up to a car battery, but we'll assume you wish to provide the 8 "C" cells accommodated by your receiver's go-anywhere design: if so, the battery holder/shelf/snap connector assembly detailed in Steps 7-2 ff. will provide 12VDC as needed for this project.

Q. What is the most important single procedure in the whole building process? ➦ A. Double-checking completed phases, step by step, for correct parts selection and orientation.

Q. Which kit-builders tend to make the most mistakes? ➦ A. Typically, professional technicians and experienced do-it-your-selfers, who ARE very good with electronics, may not have the patience to follow the steady pace of complete part-by-part directions. What to do seems so obvious to them that they "stuff the board" very quickly, and then they need to spend lots more time tracing just one or two little but critical mistakes. This is common in most hobbies and crafts.

Before Soldering ANY Parts:

You will want to do some kind of sorting and grouping of the kit parts to make them easier to find. In particular, be sure to separate the 9 molded inductors from the 21 1/4-watt resistors. The inductors have a blue-green background and are slightly fatter and shorter than the resistors. They also have a very low resistance (one ohm or less) if measured with your ohmmeter. Our 1/4-watt resistors normally have a tan background color, though NOT always! The main possibility for confusion occurs with R18 and R23, both 3.3 ohms, and L6, 3.3 microhenries, all with the same color code of orange-orange-gold-gold! R18 and R23 are installed early in Phase 1.0; simply keep L6 with the other inductors until they are installed all together.

❑ PHASE 1
Audio Amplifier Section

❑ ❑ 1-1a. Carefully identify C12, a .1 µF mylar film capacitor. It is marked 104 and has a dark, shiny somewhat rectangular body, quite different from the many ceramic disc capacitors also used in the kit.

❑ ❑ 1-1b. Install mylar film capacitor C12 per 1-1a.

❑ ❑ 1-2. Install C15, also .1 µF and marked 104, but is a ceramic disc type.

❑ ❑ 1-3. Install C13, 100 pF, marked 101.

❑ ❑ 1-4. Install C19, .01 µF, ceramic disc type marked 103.

❑ ❑ 1-5. Install C9, also .01 µF ceramic disc.

Before soldering any of the following resistors, make certain that you have selected the correct value. Pay close attention to the color of the third multiplier band, so that you don't confuse 470, 4.7K and 47 K, etc. Also don't confuse R18 or R23 with L6 -- see note on previous page. Identify and install the following resistors:

❑ ❑ 1-6. Resistor R23, 3.3 ohms (orange-orange-gold)
❑ ❑ 1-7. Resistor R18, also 3.3 ohms.
❑ ❑ 1-8. Resistor R14, 270 ohms (red-violet-brown)
❑ ❑ 1 -9. Resistor R16, 470 ohms (yellow-violet-brown)
❑ ❑ 1-10. Resistor R11, 4.7K (yellow-violet-red)
❑ ❑ 1-11. Resistor R12, 47 K (yellow-violet-orange)
❑ ❑ 1-12. Resistor R10, 1K (brown-black-red)
❑ ❑ 1-13. Resistor R13, 10K (brown-black-orange)

❑ ❑ 1-14. Identify correctly and insert Q4, transistor type 2N4124G, into its position, making sure that its flat side is oriented per the board outline. Press the transistor as far into its holes as it reasonably will go and solder all three connections.

❑ ❑ 1-15. Examine electrolytic capacitor C17, 220 µF. Notice that one wire is longer: this is the (+) side. The (-) side is marked by the dark band stripe down the side of the capacitor. This and all other electrolytic capacitors in the kit MUST be installed with the (+) side corresponding to the "+" marked on the board.

❑ ❑ 1-16. Install C17, 220 µF electrolytic, per Step 1-15.

❑ ❑ 1-17 Install C16, 470 µF electrolytic, per Step 1-15.
❑ ❑ 1-18. Install C14, 33 µF electrolytic, per Step 1-15.
❑ ❑ 1-19. Install C30, 100 µF electrolytic, per Step 1-15.
❑ ❑ 1-20. Install C11, 1 µF electrolytic, per Step 1-15.
❑ ❑ 1-21. Install C10, 470 µF electrolytic, per Step 1-15.

❑ ❑ 1-22. Using a length of bare wire cut from a part already installed, form a staple-shaped bridge wire and solder it at the two points joined by the dotted line marked JUMPER near C17.

❑ ❑ 1-23. Install R17, the 10K volume control potentiometer. Before soldering, make sure it is seated squarely on the board, to assure a neat fit to the subpanel.

❑ ❑ 1-24. Notice that U1, the 9-pin TDA2611A integrated audio amplifier circuit, has a notch and stripe at one end of the imprinted side, designating pin 1. Carefully insert U1 into its position with that notched end in the same direction as the stripe outlined on the board (i.e., near C17).

❑ ❑ 1-25. Solder all 9 pins of U1, being sure not to drip excess solder across any of the pins ("solder bridge.")

❑ ❑ 1-26. Double check the correctness of parts selection and parts-orientation in steps 1-1 through 1-25.

At this point, you have installed all parts needed for U1 and Q4 to function as the receiver's audio amplifier. This circuit can be tested at this time by connecting DC voltage and the speaker. The value of this test is that you can be assured that the amplifier circuit indeed is working properly. A potential disadvantage is that the four hookup wires installed for the test could become weakened at their solder points from the repeated handling of the board required by further assembly. Therefore, the decision to test the amplifier before proceeding depends on your confidence in the work done so far. If you do perform the test, be sure to follow the suggestion in Phase 2 for tucking the wires out of the way.

Preparation for Optional Audio Amplifier Test:

❑ ❑ 1-27. NOTE: When we say to "prepare" a length of hookup wire , this means to CUT the correct length of the specified color and to STRIP about 1/8" of insulation from each end. To assure neat wiring of the finished receiver, it is important to cut the wire lengths as specified. If any wires are too short, they will interfere with installing the battery shelf assembly.

❑ ❑ 1-28. Prepare a 5.5" length of BLACK wire and solder one end to the (-) side of “Vcc EXT".

❑ ❑ 1-29. Prepare a 4.0" length of RED wire and solder one end to the pad in the "Power Switch" nearest the position for R15.

❑ ❑ 1-30. Prepare a 5.5" length of WHITE wire and solder one end to the (+) pad on the "AUDIO OUT" box outlined on the board.

❑ ❑ 1-31. Prepare a 5.5" length of BLACK wire and solder one end to the other (ground) pad in the "AUDIO OUT" box.

❑ ❑ 1-32. Lightly solder the white (+) and black (-) wires from "AUDIO OUT" to the(+) and(-) lugs of the 3" speaker in your kit. Because this is a temporary connection, you also may use alligator clip jumper wires. These two wires will be soldered permanently to the phone jack later.

Phase 1 Optional Progress Test

The purpose of this test is to make sure that the amplifier section is working property. If it does not, installing more parts will not fix it!

❑ ❑ 1-33. DOUBLE-CHECK all preceding assembly steps.

❑ ❑ 1-34. Connect any 11-14 volt DC voltage source to the red (+) and black (-) wires.

❑ ❑ 1-35. Turn the volume control all the way up.

At this point you should be hearing a gentle background hiss and perhaps a soft AC hum. Now, touch one end of R10 with your finger or a voltmeter test lead: you should hear a strong AC hum. Rotating the volume control will have the same effect as any volume control. These are the ONLY sounds you should hear. There must NOT be any popping, putt-putting or squealing. If there are ANY such sounds, it means that the amplifier is oscillating, caused by some error in preceding steps. Make sure you have the amplifier working properly before proceeding.

❑ ❑ 1-36. Disconnect the battery or power supply.
❑ ❑ 1-37. Disconnect the speaker.

❑ PHASE 2
DC Voltage Control and Regulation

❑ ❑ 2-1. Install diode D11, type 1N4002, making sure that its banded cathode end is oriented as outlined on the board.

❑ ❑ 2-2. Install diode D12, type 1N4002, per step 2-1.

❑ ❑ 2-3. Install resistor R15, 3.3K (orange-orange-red).

❑ ❑ 2-4. Gently loop the 4 wires installed for the Phase 1 audio test around the body of the R17 volume control so that their connections will not be weakened during further assembly.

Install the following resistors:

❑ ❑ 2-5. Resistor R26, 560 ohms (green-blue-brown).
❑ ❑ 2-6. Resistor R27, 4.7K (yellow-violet-red).
❑ ❑ 2-7. Resistor R24, 22K (red-red-orange).
❑ ❑ 2-8. Resistor R9, 10K (brown-black-orange).

❑ ❑ 2-9. Referring back to Step 1-14 as needed, install Q5, the other MPS6514 transistor supplied with your kit.

❑ ❑ 2-10. Review Step 1-15 regarding the correct installation of ELECTROLYTIC capacitors, noting that the (+) side for each capacitor is clearly marked on the board.

❑ ❑ 2-11. Install C33, 33 µF electrolytic, per Steps 2-10, 1-15.
❑ ❑ 2-12. Install C32, 100 µF electrolytic, per Steps 2-10, 1-15.
❑ ❑ 2-13. Install C29, 10 µF electrolytic, per Steps 2-10, 1-15.

❑ ❑ 2-14. Examine U2, the 3 pin type 7805 voltage regulator. It must be installed with its imprinted side facing R27. The line within its board outline designates the bare metal heatsink side.

❑ ❑ 2-15. Install voltage regulator U2 per step 2-14.

❑ ❑ 2-16. Referring to Step 1-22 as needed, install a bare wire jumper at "JUMPER" near "R20A." (NOTE: R20A, R20B, and R20C are the connecting points for the main tuning control.)

❑ ❑ 2-17. Double-check your work in Steps 2-1 to 2-16.

This completes the wiring of the DC voltage regulation circuitry. While the output of U2 could be checked for 8 volts, no testing is necessary at this point.

❑ PHASE 3
RF Amplifier, Regenerative Detector, Varactor Tuning

❑ ❑ 3-1. Varactor diode D10 is easy to identify; it looks like a transistor, but with only two leads, and is clearly stamped MV209. Before soldering D10, make sure its flat side is aligned just like the board outline and that its body is snugly against the top of the board.

❑ ❑ 3-2. Install Transistor Q1, FET type J310. Before soldering, be sure that its flat side faces C2 as outlined on the board. Also, before soldering, make Sure Q1's leads are pushed into the board holes as far as "possible, placing the transistor's body as close to the board as reasonably possible.

❑ ❑ 3-3. Install transistor Q2, FET type J310, per step 3-2.

❑ ❑ 3-4. Install transistor Q3, FET type J310, per step 3-2.

❑ ❑ 3-5. Referring back to step 1-15 as needed, install C5, a 1 µF electrolytic capacitor, correctly aligning its (+) side.

❑ ❑ 3-6. Install 1 µF electrolytic C31 per Step 3-5.

❑ ❑ 3-7. Press R6, 100K regeneration trimmer pot, into its position. The preformed "legs" lock it into position for easy soldering. **Do NOT try to jam the trimmer's body flush against the board.** Solder all three legs.

As you did in Phases 1 and 2, be sure to correctly identify the following resistors before soldering. Install the following:

❑ ❑ 3-8. Resistor R3, 10 ohms (brown-black-black).
❑ ❑ 3-9. Resistor R7, 1K (brown-black-red).
❑ ❑ 3-10. Resistor R25, 1.5K, (brown-green-red).
❑ ❑ 3-11 . Resistor R8, 470 (yellow-violet-brown).
❑ ❑ 3-12. Resistor R2, 680, (blue-gray-brown).
❑ ❑ 3-13. Resistor R19, 10K (brown-black-orange).
❑ ❑ 3-14. Resistor R4, 1 megohm (brown-black-green).
❑ ❑ 3-15. Resistor R22, also 1 megohm.

❑ ❑ 3-16. Set aside the 9 .01 1tF mylar capacitors to be used for C20-C27 in Phase 6. These capacitors are marked 103 and are easily recognized by their dark, shiny rectangular bodies.

Install the following ceramic disc capacitors. **** Be sure NOT to use any of the .01 µF mylar capacitors required for C20-C27:**

❑ ❑ 3-17 Capacitor C2, 33 µF.
❑ ❑ 3-18. Capacitor C1, 100 pF (marked 101).
❑ ❑ 3-19. Capacitor C18, 220 pF (marked 221).
❑ ❑ 3-20. Capacitor C4, .01 µF (marked 103) **
❑ ❑ 3-21. Capacitor C6, also .01 µF. **
❑ ❑ 3-22. Capacitor C7, also .01 µF. **
❑ ❑ 3-24. Capacitor C3, also .01 µF. **
❑ ❑ 3-25. Capacitor C8, .1 µF (marked 104).

❑ ❑ 3-26. Install RF Gain control, 10K potentiometer R1, seating the control squarely on the board before soldering. This is important to assure a good fit to the aluminum subpanel.

❑ ❑ 3-27. Install Regeneration Control R5 per Step 3-26.

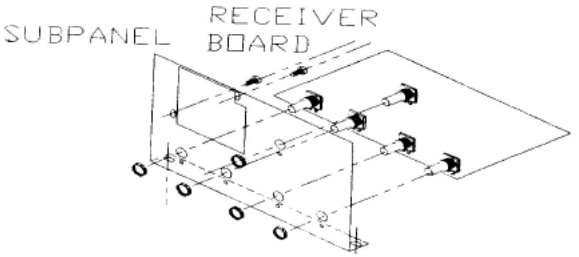
❑ ❑ 3-28. Install Fine Tuning Control R21 per Step 3-26.

❑ ❑ **3-29. Coaxial Cable Preparation:**

- ❑ A. Strip 1/2" of the outer black insulation from each end of the RG 174 mini coax cable.
- ❑ B. Gently unravel the exposed braids and twist the strands to form single stranded conductors.
- ❑ C. C. Strip 1/8" of the inner insulation from the center conductor at each end.
- ❑ D. Lightly tin the exposed braids and center conductors.

❑ ❑ 3-30. Solder one end of the cable prepared in 3-29 to the ANTENNA points near the RF Gain control: the center conductor is soldered to the "IN" pad, and the braid is soldered to GND.

❑ ❑ 3-31. Gently slip the subpanel over the shafts and bushings of the four board-mounted controls until it is flush against the fronts of the controls. Notice how the locking pins should fit into the small holes of the subpanel. (**Do NOT mount washers and nuts yet.**)



❑ ❑ 3-32. Notice how the bottom lip of the subpanel covers the first half-inch or so of the entire front of the board' Remove the subpanel, because NOW is the time to check this front area of the board for:

- ❑ Correct parts selection
- ❑ Solder joint touchup
- ❑ Wires properly trimmed to prevent shorting
- ❑ Solder bridges
- ❑ Correct soldering of controls so their locking pins fit the corresponding holes of the subpanel
- ❑ No loose strands of coax braid shorting to other
- ❑ points on the board

❑ ❑ 3-33. At this point, you have installed all regeneration circuit parts except L10 and C43. Before proceeding, please study **"Detail 3-44: Note on L10 and C43"** at the end of this section.

❑ ❑ 3-34. Capacitor C43 installed ❑ not installed ❑ Per 3-44.
❑ ❑ 3-35. Inductor L10 installed ❑ not installed ❑ date_____

❑ ❑ 3-36. After performing all inspections of the front area of the board explained in Step 3-32, mount the subpanel to the board using a washer and 5/8" nut for each control.

❑ ❑ 3-37. Mount the Main Tuning control (R20) in its position on the subpanel using the remaining washer and nut.

❑ ❑ 3-38. Prepare three 4.0" lengths of WHITE hookup wire, referring to Step 1-27 as needed.

❑ ❑ 3-39. Solder one end of each of the three white wires to each of the three lugs of the Main Tuning control.

❑ ❑ 3-40. Solder the wire from the lug nearest the large opening for the bandswitch board to "R20A" on the board.

❑ ❑ 3-41. Solder the wire from the center (wiper) lug to R20B.

❑ ❑ 3-42. Solder the remaining wire to R20C.

❑ ❑ 3-43. Use any kind of tape to temporarily secure the antenna coax to the subpanel during further assembly. It is important that the solder connections not be stressed by repeated cable movement.

❑ ❑ Detail 3-44: Note on L10 and C43

These two components are additions to the original circuit: the receiver works quite well without them. Adding L10 and C43 results in a significant boost in receiver sensitivity to weak signals but also requires somewhat more careful adjustments of the Regeneration Control. If this is your first experience with regenerative receivers, we suggest that you omit L10 and C43 for now and gain real familiarity with the receiver's operation.

Consider adding these parts later if your listening interests begin to include looking for weak CW or SSB signals on bands which are nearly deserted because of time of day or sunspot conditions. If those same bands are busy with strong signals, the receiver works fine without L10 and C43, to the extent that the RF Gain control setting will need to be reduced considerably.

The extra sensitivity offered by this circuit addition also can permit the use of shorter antennas such as telescoping whips for portable operation.

Adding L10 and C43 later will require a major dismantling of the receiver, including removal of the subpanel installed in Step 3-36. However, an easier approach is possible which also permits you to try out the increased regeneration sensitivity without committing to it permanently. For now, install C43 in the normal manner. By itself, it will have no effect on receiver operation. In the position marked on the board for L10, solder two bare wires extending about 1/2" above the board. Whenever you wish, L10 can be soldered to these two wires after removing only the top cover shell and battery shelf . This will allow you to compare receiver performance with and without C43 and L10.

Inductor L10 is a 100 µH RF choke resembling the smaller electrolytic capacitors but with no polarity stripe or one lead being longer than the other. C43 is a .01 µF ceramic disc type.

Return to step 3-34 after deciding about L10 and C43.

❑ PHASE 4
Basic Receiver Operation Test

The purpose of this assembly phase is to let you verify that the receiver indeed WORKS as the cumulative result of your good work done in Phases 1, 2 and 3. We can do this by wiring in the parts needed to tune around one popular and active band, connecting antenna, speaker and DC voltage and then just play with it for a while. For this test, we'll chose Band 4 (6.8 to 8.5 MHz.), a tuning range which includes the 40 meter amateur band as well as numerous other transmissions. We will activate this band by directly connecting the supply voltage intended for the bandswitch control board. This test is not necessary if you prefer to move ahead to complete receiver assembly: there will simply be more details to troubleshoot if the receiver does not perform as specified.

❑ ❑ 4-1. Install molded coil L4, 8.2 µH (gray-red-gold-gold).

❑ ❑ 4-2. Install C23, a .01 µF " MYLAR" capacitor marked 103.

❑ ❑ 4-3. Install D4, one of the 9 tiny 1SS135 PIN diodes in your kit, making sure that its banded cathode end is oriented as outlined on the board (i.e., pointing toward C29/Q5).

❑ ❑ 4-4. Prepare a 3" length of RED hookup wire and solder one end to "X" near Q5.

❑ ❑ 4-5. Solder the other end of the red hookup wire (4-4) to the rearmost pad for " C37 " (a capacitor position NOT used in the standard version of this receiver.) This wire connection has the effect of a temporary +8VDC connection to the "Band 4" point.

❑ ❑ 4-6. Reconnect the white and black "AUDIO OUT" wires to the speaker per 1-32.

❑ ❑ 4-7. Connect an outdoor antenna or at least 10' of hookup wire to the center conductor of the coax cable.

❑ ❑ 4-8. Turn ALL panel controls completely to the left.

❑ ❑ 4-9. Re-connect 11-15 volts DC to the red and black wires used in the Phase 1 test.

❑ ❑ 4-10. Turn the volume control fully clockwise and then back to its middle position. With all other controls turned to the left, you should hear only a soft hiss during volume control rotation.

❑ ❑ 4-11. Set the RF Gain and both tuning controls to their middle positions.

❑ ❑ 4-12. Slowly turn the Regeneration control clockwise until you hear a sudden boost in background hiss, or a slight whistle or actual signals. If this does not happen, proceed to step 4-14.

❑ ❑ 4-13. If you DID experience the effect of the Regeneration control described in 4-12, you can now try the Main Tuning to find various stations in the 6.8 to 8.5 MHz tuning range. You may wish to study pages 49 and 51 regarding the functions of the controls, particularly RF Gain and Regeneration.

❑ ❑ 4-14. If you did NOT experience regeneration as described in 4-12, an initial adjustment of trimmer R6 must be done with a mini screwdriver or alignment blade. Procedure:

❑ Turn Regeneration control to its middle position
❑ Set R6 fully counter-clockwise
❑ Adjust R6 slowly until the increased hiss or slight whistle of regeneration just begins.
❑ Turn Regeneration control fully counter-clockwise and then advance it until regeneration just begins.

NOTE: It is normal for the rotation of R6 to generate loud crackles and pops. Also, with the circuit board not mounted inside the receiver cabinet, it is normal to hear some AC buzz from nearby electrical wiring.

❑ ❑ 4-15. After you've finished exploring your one-band receiver, disconnect DC power and speaker, and carefully unsolder the red wire from the C37 pad near L4. This wire will soon be soldered permanently to the Bandswitch control board.

❑ ❑ 4-16, Preparation of Main Tuning Knob

Probably, You never wondered or cared how those white stripes happen to appear on radio knobs! well, they can be grooves filled with paint, or silkscreened, or they can consist of a thin wedge of colored plastic pressed into a slit on the side of the knob. And, how does the setscrew get from the bin into the knob? While these processes can be automated for truly huge production runs, the painting of index stripes and insertion of set screws is commonly done by hand, even in knob factories.

We provided this economical receiver kit with the very same made-by-TEN-TEC Main Tuning knob designed for our Model 555 Scout HF transceiver and the T-KIT 1220 VHF transceiver. Since those applications do not require any marking on the main tuning knob, we invite our other kit builders to taste the sheer fun of how easy it is to place a neat index stripe on ANY knob with molded grooves. After you try it, you may want to freshen up the index stripes on the knobs of every radio or electronic gadget in your household or shop!

With a small arts/crafts brush or even a Q-tip, paint a drop of WATER-based (latex or acrylic) enamel into one groove of the main tuning knob. Don't worry if some paint is left on the outer rim of the knob outside the grove. Let the paint dry about 10 minutes, then try cleaning off any excess paint outside the grove with a DRY smooth cloth or paper towel. If necessary, moisten the towel very slightly to help dissolve unwanted paint-traces. Rub patiently. The result should be a uniform coating of paint within one groove on the side of the knob.

If you used a water-based paint and did a lousy job, don't worry at all. Promptly use a wet rag or toothbrush to scrub out the paint: rinse the knob, dry it and try the painting again.

We suggest water-based paint simply because there's no way that using water as a solvent or cleaner can damage the knob itself. If you have other skills and experience with art or model-finishing, just use the paint and techniques most familiar to you.

❑ ❑ 4-17. Use a #4 Allen wrench to insert and secure the supplied allen-type #4-40 set-screw into the tuning knob. This same size wrench is also used to tighten ALL knob setscrews.

❑ PHASE 5

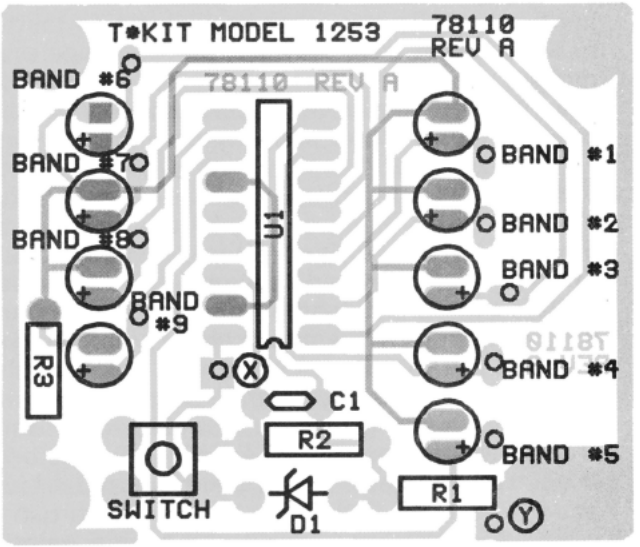
Electronic Band Switching Control Board

First, simply examine the circuit board itself and observe that there are traces and pads on both sides, meaning that soldering will be done on both sides, with parts mounted on both sides.

To avoid confusion, refer to the following chart as you proceed. The BACK side includes the silkscreened lettering and some traces and pads. The FRONT side has most of the circuit traces and will face the front panel in final assembly.

Also, notice that this circuit board has its own schematic designators (R1,C1,U1, etc.), not to be confused with parts on the main receiver board.

Refer to this drawing carefully if you have ANY question about the LED anode positions (+) imprinted on the board itself.



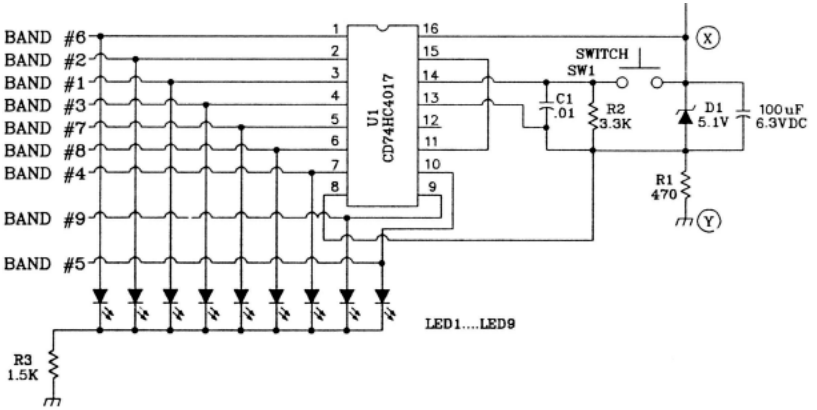


Chart 5.1:

Part or Connection	INSERTED ON	SOLDERED ON
R1, R2, R3, D1, C1	back	front
U1 or 16-pin socket	back	front
LED1-LED9	front	back
Switch	front	back
Wires from main board	back	front

Install the resistors, capacitors and zener diode per Chart 5.1:

❑ ❑ 5-1. Resistor R1 , 470 ohms (yellow-violet-brown).
❑ ❑ 5-2. Resistor R2, 3.3K (orange-orange-red).
❑ ❑ 5-3. Resistor R3, 1.5K (brown-green-red).
❑ ❑ 5-4. Capacitor C1, .01 RF mylar film, marked 103.
❑ ❑ 5-5. 5.1V Zener diode D1; orient cathode band as outlined. The 100mfd. 6.3vdc cap goes across zener D1 on display board with the plus side of the cap on the band end of the diode.
❑ ❑ 5-6. READ FIRST: The CD74HC4017 16-pin decade counter IC may be soldered safely directly to the board. If you prefer to supply your own 16-pin DIP socket, use the same care in soldering the socket pins and inserting the IC as you would in soldering the IC directly. Work carefully with a very clean soldering tip to avoid dripping excess solder and forming solder bridges. Notice the IC has a notch at the end designated pins 1 and 16. This notched end MUST be oriented toward C1 and R2 per the notch outlined on the board.

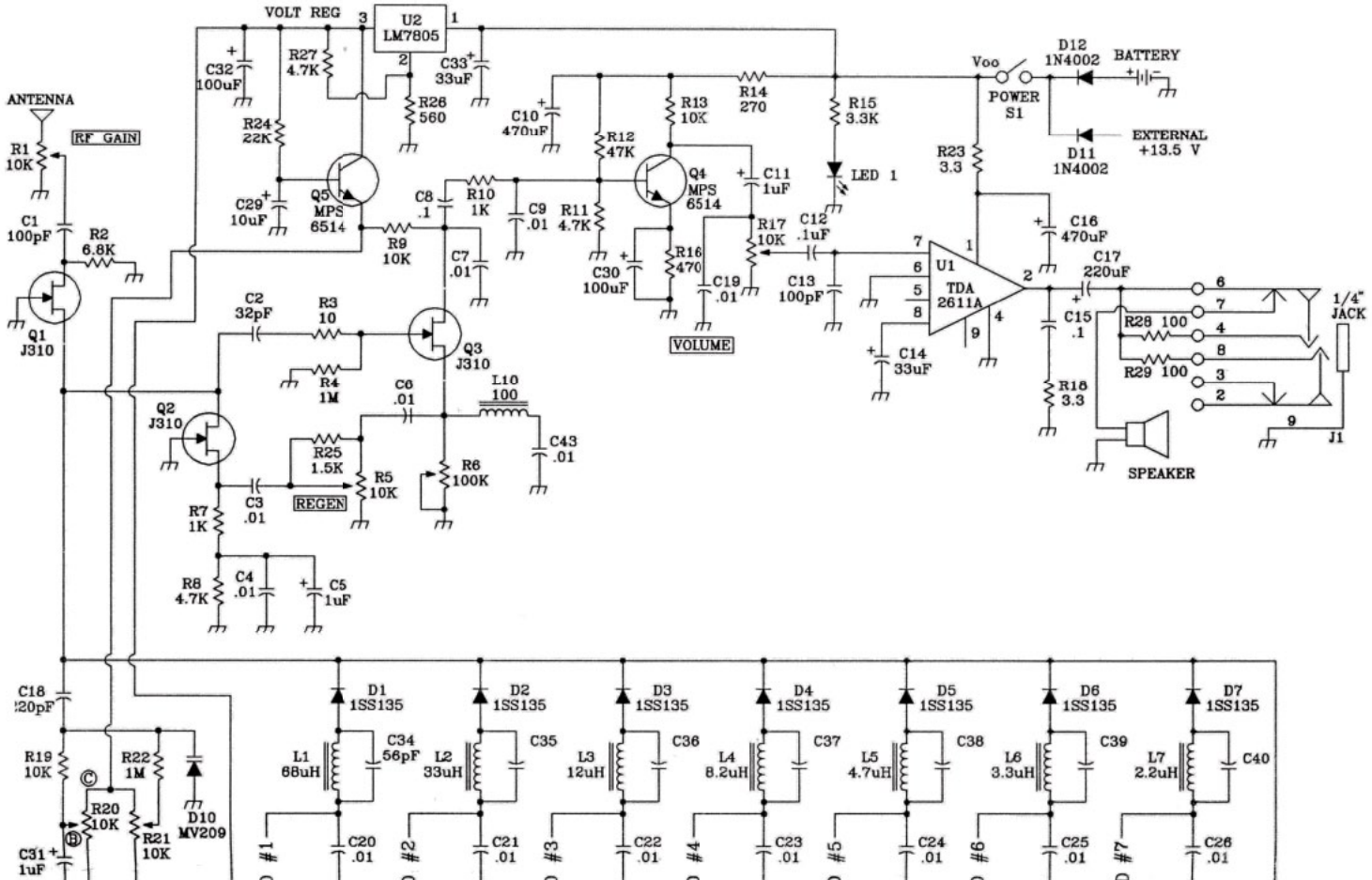
❑ ❑ 5-7. Install the U1 decade counter IC or a 16-pin DIP socket IC per 5-6 and Chart 5.1.

❑ ❑ 5-8. The nine LED's will be installed and soldered as a single operation in order to assure a neat fit of the LED bulb tips into their front panel holes. PLEASE follow our directions for this procedure exactly.

❑ ❑ 5-9. Note that the ANODE side of each LED is clearly marked by a " + " within the circles outlined on the board and that the anode is the longer of the two wire leads of the LED.

❑ ❑ 5-10. Insert all 9 LED's, making sure the anodes are oriented correctly per 5-9. Bend the leads slightly so the LED's do not slip back out **but do NOT solder yet.**

Model 1253 Schematic Diagram on pages 32-33 ➲


VOLT REG
U2
LM7805
ANTENNA
RF GAIN
R1
10K
C1
100pF
R2
6.8K
Q1
J310
C32
100uF
R27
4.7K
R24
22K
C29
10uF
R26
560
Q5
MPS
6514
C33
33uF
C8
.1
R10
1K
R9
10K
C7
.01
C9
.01
R11
4.7K
C10
470uF
R12
47K
R13
10K
R14
270
R15
3.3K
Q4
MPS
6514
C30
100uF
R16
470
C11
1uF
C19
.01
VOLUME
R17
10K
C12
.1uF
C13
100pF
LED 1
Voo
POWER
S1
D12
1N4002
BATTERY
D11
1N4002
EXTERNAL
+13.5 V
R23
3.3
U1
TDA
2611A
C14
33uF
C16
470uF
C17
220uF
C15
.1
R18
3.3
SPEAKER
R28 100
R29 100
1/4"
JACK
J1
C2
32pF
R3
10
R4
1M
Q3
J310
Q2
J310
C6
.01
L10
100
C43
.01
R25
1.5K
R5
10K
R6
100K
REGEN
C3
.01
R7
1K
R8
4.7K
C4
.01
C5
1uF
C18
220pF
R19
10K
R22
1M
R20
10K
R21
10K
D10
MV209
C31
1uF
D1
1SS135
D2
1SS135
D3
1SS135
D4
1SS135
D5
1SS135
D6
1SS135
D7
1SS135
L1
68uH
C34
56pF
L2
33uH
C35
L3
12uH
C36
L4
8.2uH
C37
L5
4.7uH
C38
L6
3.3uH
C39
L7
2.2uH
C40
#1
C20
.01
#2
C21
.01
#3
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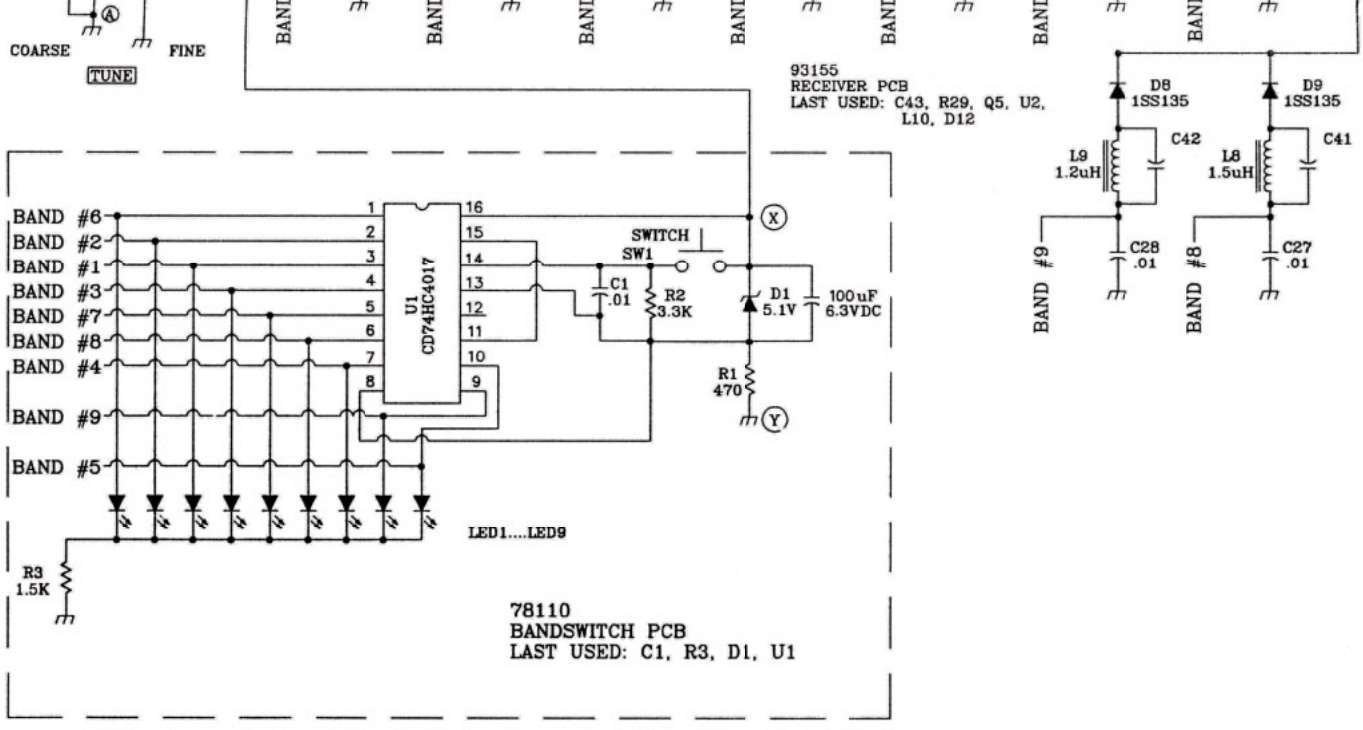
C24
.01
#6
C25
.01
#7
C26
.01



T-KIT Model 1253 Receiver
Schematic Diagram

❑ ❑ 5-11. Set the main chassis/panel face down on a clean, non-abrasive surface, and then lay the bandswitch board down inside the front panel so that the two rows of LED's match their front panel holes. Press gently so that all 9 LED bulb tips fit neatly and uniformly into the holes.

❑ ❑ 5-12. Double-check correct anode orientation for each LED.

❑ ❑ 5-13. After making sure you have sufficient lighting for doing soldering within the U-shape of the chassis/panel, start soldering at least one lead of each LED. Start with the LED's easiest to reach with your soldering tip and cut away excess leads frequently: this will give you more working room.

❑ ❑ 5-14. Remove the board and set aside the chassis/panel.

❑ ❑ 5-15. Insert the pushbutton switch in its position on the front of the board and solder all four pins to the pads on the front of the board.

❑ ❑ 5-16. Double-check all work done in the preceding steps. The switch board is now functional, requiring the following hookup wire installations.

Prepare the following nine WHITE hookup wires and solder one end of each wire to its position on the bandswitch board:

WIRE GROUP 1-5:
❑ ❑ 5-17. Band 1, 5.25 inches.
❑ ❑ 5-18. Band 2, 5.50 inches
❑ ❑ 5-19. Band 3, 5.75 inches
❑ ❑ 5-20. Band 4, 6.00 inches
❑ ❑ 5-21 . Band 5, 6.25 inches
WIRE GROUP 6-9:
❑ ❑ 5-22. Band 6, 5.50 inches
❑ ❑ 5-23. Band 7, 5.75 inches
❑ ❑ 5-24. Band 8, 6.00 inches
❑ ❑ 5-25. Band 9, 6.25 inches

❑ ❑ 5-26. **READ FIRST:** The bandswitch board is mounted in its position on the FRONT SIDE of the subpanel using two 1/4" #4-40 screws, #4 lock-washers and #4-40 hex nuts. **DO NOT** do a "final" tightening, because the board will need to be adjusted as the subpanel and main board assembly is mounted to the panel/chassis. The screws are inserted from the back side of the subpanel, through the board and secured by the washer and nut. All wires pass through the large opening for soldering to the main receiver board.

❑ ❑ 5-27. Mount the bandswitch board on the front of the subpanel as explained_in Step 5-26. Again, remember that a "final" tightening is NOT done at this time.

❑ ❑ 5-28. Solder the 3" RED wire from "X" on the main board (steps 4-4, 4-5) to "X" on the bandswitch board.

❑ ❑ 5-29. Prepare a 3" length of BLACK wire. solder one end to "Y" on the main board and-the other end to "Y" on the band-switch board.

❑ ❑ 5-30. Double-check all work done in steps 5-1 to 5-29.

Chart 6.1: T-KIT Model 1253 Receiver Bandswitching Quick-Reference Chart

Band	Coil-Value	Color Code	Wire Length
1	L1-68 µH	blue-gray-black-gold	5.25"
2	L2-33 µH	orange-orange-black-gold	5.50"
3	L3-12 µH	brown-red-black-gold	5.75"
4	L4-8.2 µH	gray-red-gold-gold	6.00"
5	L5-4.7 µH	yellow-violet-gold-gold	6.25"
6	L6-3.3 µH	orange-orange-gold-gold	5.50"
7	L7-2.2 µH	red-red-gold-gold	5.75"
8	L8- 1.5 µH	brown-green-gold-gold	6.00"
9	L9-1.2 µH	brown-red-gold-gold *	6.25"

* or silver

❑ PHASE 6
Band Switching Components and Connections

❑ ❑ 6-1. Install c34, 56 pF. NOTE: C34 is the only capacitor installed for C34-C42, all of which provide for putting capacitance in parallel with an inductor.

Install the following nine .01 µF mylar film bypass capacitors, using whatever insertion/soldering/trimming sequence seems most efficient to you:

❑ ❑ 6-2. C20, .01 µF mylar film capacitor, marked 103
❑ ❑ 6-3. C21, " " " "
❑ ❑ 6-4. C22, " " " "
❑ ❑ 6-5. C23, " [probably installed in Testing Step 4-2]
❑ ❑ 6-6. C24, .01 µF mylar film capacitor, marked 103
❑ ❑ 6-7. C25, " " " "
❑ ❑ 6-8. C26, " " " "
❑ ❑ 6-9. C27, " " " "
❑ ❑ 6-10. C28, " " " "

Install the following nine 1N4148 part # 28001 diodes, using whatever insertion/soldering/trimming procedure seems most efficient to you:

❑ ❑ 6-11. PIN diode D1, with cathode oriented per board outline.
❑ ❑ 6-12. PIN diode D2 " " "
❑ ❑ 6-13. PIN diode D3 " " "
❑ ❑ 6-14. PIN diode D4 [probably installed in Testing step 4-31]
❑ ❑ 6-15. PIN diode D5, with cathode oriented per board outline.
❑ ❑ 6-16. PIN diode D6 " " "
❑ ❑ 6-17. PIN diode D7 " " "
❑ ❑ 6-18. PIN diode D8 " " "
❑ ❑ 6-19. PIN diode D9 " " "

❑ ❑ 6-20. COIL INSTALLATION: correct installation order of inductors L1-L9 are important to the intended tuning coverage of your receiver. Any mistakes in the following procedure will result in mixups in frequency band selection. The inductors directly determine the tuning ranges of all bandswitch selections. There is no right or wrong direction for inserting the inductors, but a consistent pattern is helpful for double-checking your work. i.e., orient the first two bands of all 9 coils in the same direction, one way or the other.

Install the following molded inductors per Step 6-20:

❑ ❑ 6-21. Coil L1, 68 µH, (blue-gray-black-gold)
❑ ❑ 6-22. Coil L2, 33 µH, (orange-orange-black-gold)
❑ ❑ 6-23. Coil L3, 12 µH, (brown-red-black-gold)
❑ ❑ 6-24. Coil L4, 8.2 µ1, (gray-red-gold-gold) [Done in Step 4-1)
❑ ❑ 6-25. Coil L5, 4.7 µH, (yellow-violet-gold-gold)
❑ ❑ 6-26. Coil L6, 3.3 µH, (orange-orange-gold-gold)
❑ ❑ 6-27. Coil L7, 2.2 µH, (red-red-gold-gold)
❑ ❑ 6-28. Coil L8, 1.5 µH, (brown-green-gold-gold)
❑ ❑ 6-29. Coil L9, 1.2 µH, (brown-red-gold-gold [or silver])

❑ ❑ 6-30. Solder the WHITE wires from the bandswitch board to their corresponding positions on the receiver board:

WIRE GROUP 1-5:
❑ ❑ 6-31. Band #1, 5.25 inches
❑ ❑ 6-32. Band #2, 5.50 inches
❑ ❑ 6-33. Band #3, 5.75 inches
❑ ❑ 6-34. Band #4, 6.00 inches
❑ ❑ 6-35. Band #5, 6.25 inches

WIRE GROUP 6-9:
❑ ❑ 6-36. Band #6, 5.50 inches
❑ ❑ 6-37. Band #7, 5.75 inches
❑ ❑ 6-38. Band #8, 6.00 inches
❑ ❑ 6-39. Band #9, 6.25 inches

❑ ❑ 6-40. Double-check Diodes D1-D9 for correct orientation of the cathode bands.

❑ ❑ 6-41 . Double-check Inductors L1-L9 for correct values.

❑ ❑ 6-42. Double-check the 9 white wires to make sure that "Band 1" on the switch board is connected to "Band #1 " on the receiver board, and so forth.

CABLE TIES: *Study how they are made but DON'T "play" with them. Once the pointed end of the long strip is pulled through the rectangular slot, it can be pulled only tighter, not backed out very easily! Replacement cable ties are a common Radio Shack™ or automotive store item.*

❑ ❑ 6-43. Attach a cable tie around Wire, Group 1-5, about 1 " from the wire for Band 5 near the switch board. Pull the tie tight, making the beginning of a neat bundle of wires. Trim away the excess pull-through strip.

❑ ❑ 6-44. Keeping the Group 1-5 bundle neat and tight, secure a second cable tie about 1" from the first one.

❑ ❑ 6-45. Secure a third cable tie around the Group 1-5 bundle near the position of L1 on the main board. The result should be a neat cable running down the inside of the subpanel, along the edge of the receiver board, with neat connection lengths to Band #1 through Band #5.

❑ ❑ 6-46. Referring to your experience with steps 6-43 to 6-45, make a neat bundle for wire Group 6-9, using two cable ties. The first tie should be near the bandswitch board, with one more in the middle of the cable bundle near the U2 regulator IC.

Bandswitch Board Test (Optional)

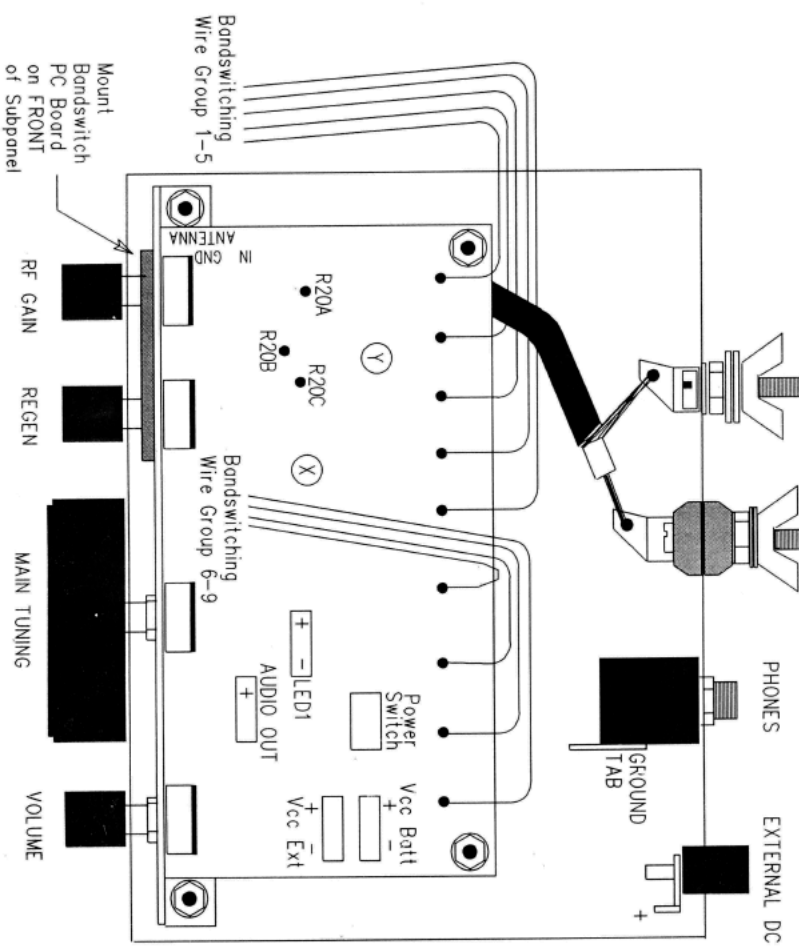
❑ ❑ 6-47. It this simple test is not conducted now, it will be necessary to partially disassemble the completed receiver to determine any problem. If you are fully confident in the correctness and quality of your work in Phase 6, proceed with the work in Phase 7. At this point, you have the choice to simply connect DC voltage to check for proper operation of the bandswitching system OR also to reconnect speaker and antenna to try out the receiver outside of its cabinet. We recommend only the simpler test, because there can be no useful final adjustment of trimmer R6 until the board is mounted in its intended environment. Also, the unshielded board assembly may exhibit annoying AC ripple or hum which is not characteristic of the properly-completed receiver.

TEST PROCEDURE:

❑ ❑ 6-48. Reconnect 12-15 VDC to the red and black wires used in previous tests.

❑ ❑ 6-49. Upon connection of DC voltage, ONE (only) band LED should be illuminated. This is normally but not necessarily Band 1. While grasping the subpanel for steadiness, gently and quickly press the switch button with your finger or the eraser end of a pencil. Each press of the button should advance the decade counter IC to light the next LED. Press the button to take the counter through all 9 bands, several times if you wish. Don't be alarmed if there is an occasional skip to a higher band under these test conditions. DO be concerned if there are one or more LED's which NEVER light, an indication of an assembly problem which must be corrected before final assembly.

Figure 7.1: Overview of interconnections between receiver board and external items (See further illustrations for more detail)



❑ PHASE 7

Final Wiring, Connections, Mechanical Assembly

❑ ❑ 7-1. If you did not double-check all parts values, parts orientation and solder connections as recommended after completing each phase, NOW is most certainly the lime to do so! We designed this receiver to be satisfying to build right the first time, NOT to be taken apart repeatedly!

❑ ❑ 7-2. If you did not do so already, mount both "C" battery holders to the battery shelf using four #4 self-tapping screws. The battery holder snap connectors should line up with the two big notches at one end of the shelf . The battery holders are on the top of the shelf, and the mounting flange points down.

❑ ❑ 7.3. To obtain 12 volts DC, the use of 4 "C" cells in series (6 volts) with an identical set of 4 "C" cells requires a correctly polarized series connection between the two battery holders, as explained in steps 7-4 through 7-7.

❑ ❑ 7-4. **READ FIRST:** Attach both battery snap connectors to the matching terminals on the two battery holders. Note that a BLACK wire of one connector is immediately across from the RED wire of the other connector: soldering these two wires together will place the two sets of 4 batteries in series tor 12 volts output. Proceed to Step 7-5.

❑ ❑ 7-5. Per Step 7-4, CUT the black and red wires nearest each other from the two battery holders to about 1.5.

❑ ❑ 7-6. Strip 1/8" to 1/4" of insulation from both wires cut in step 7-5, twist the bare conductors together and solder them. Wrap a short piece of your own electrical tape around this solder connection.

❑ ❑ 7-7. The remaining black (-) and red (+) wires from the battery assembly are stripped, tinned and ready to use.. With 8 "C" batteries installed, the finished battery shelf assembly may now serve as a 12VDC supply for any receiver tests prior to final assembly.

❑ ❑ 7-8. Mount the DC power connector in the upper left corner of the rear panel, using the #2-56 screws, nuts and lockwashers, the smallest such hardware in your kit.

❑ ❑ 7-9. Prepare a 4.0" length of RED wire and solder one end to the other pad in the "Power Switch" box outlined on the board. (One such wire was installed in Step 1-29.)

❑ ❑ 7-10. Prepare a 5.5" length of RED wire and solder one end to the { + } side of "Vcc Ext." (A black wire to (-) was installed in Step 1-28.)

❑ ❑ 7-11. Prepare a 3.25" length of RED wire and solder one end to the (+) side in the box marked "LED1 ."

❑ ❑ 7-12. Prepare a 3.25" length of BLACK wire and solder one end to the (-) side in the box marked "LED1."

❑ ❑ 7-13. Secure the three wires from the Main Tuning control with a cable tie about 1.25" from the control.

❑ ❑ 7-14. Inspect the entire circuit board for cold solder joints, solder bridges, untrimmed wires, or scraps of wire lodged between solder connections.

❑ ❑ 7-15. Solder the RED wire from the battery shelf assembly to the (+) side of the "Vcc Batt" box outlined on the board.

❑ ❑ 7-16. Solder the BLACK wire from the battery shelf assembly to the (-) side of the "Vcc Batt" box outlined on the board.

❑ ❑ 7-17. Set the bandswitch pushbutton into its rectangular hole on the front panel. If you find it helpful temporarily hold it in place with a small piece of tape.

❑ ❑ 7-18. Loosen the two screws holding the bandswitch board to the subpanel, then set the board/subpanel assembly inside the chassis/panel. Adjust the bandswitch board until all 9 LED's fit neatly into their front panel holes. Then tighten both mounting screws of the bandswitch board.

❑ ❑ 7-19. Notice the four slots on the bottom of the chassis: these are designed to permit sliding of the board/subpanel assembly for a perfect fit of the LED-9, etc., before final tightening of screws.

❑ ❑ 7-20. Loosely mount the rear of the receiver to the chassis using the two 1/2” #4-40 screws, the two spacers between the chassis and the board, and #4 lock washers and #4-40 hex nuts on the top side of the board.

❑ ❑ 7-21. Loosely mount the subpanel to the chassis using two 3/8" #4-40 screws through the chassis and subpanel, with #4 lock washers and #4-40 hex nuts on the top side subpanel flange.

❑ ❑ 7-22. Adjust the board/subpanel assembly toward the front panel so that the LED's fit neatly in their holes **and that the switch button works properly.** While holding the subpanel firmly, tighten the subpanel mounting screws. Then, tighten the rear mounting screws of the receiver board.

❑ ❑ 7-23. Secure the 3" speaker with its mounting plate to the top shell, using four (each) 3/8 #4-40 screws, #4 lock washers and #4-40 hex screws.

❑ ❑ 7-24. Prepare a 9" length of WHITE hookup wire and solder one end to the (+) lug of the speaker.

❑ ❑ 7-25. Prepare a 9" length of BLACK hookup wire and solder one end to the (-) lug of the speaker.

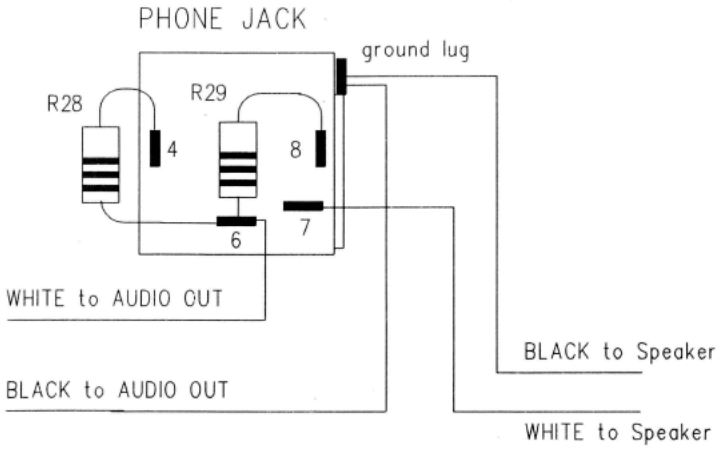
❑ ❑ 7-26. Referring to Figure 7.2 as needed, examine the pattern of lugs on the back of the 1/4" phone jack.

❑ ❑ 7-27. Cut in half both wire leads of R28, 100 ohms (brown-black-brown) and solder one end of R28 to lug 4 of the jack.

❑ ❑ 7-28. Cut in half both wire leads of R29, also 100 ohms and solder one end of R29 to lug 8 of the jack.

❑ ❑ 7-29. Solder the remaining ends of R28 and R29 PLUS the other end of the WHITE wire from "AUDIO OUT" to lug 6 of the phone jack.

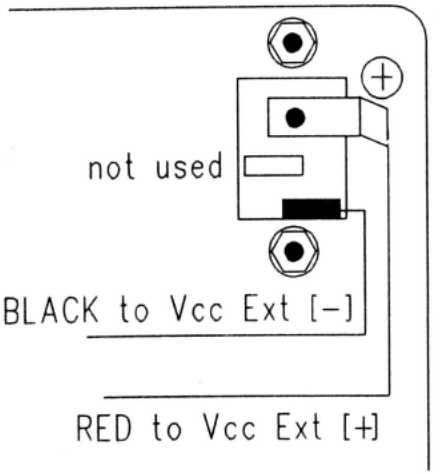
Figure 7.2



❑ ❑ 7-30. The jack's ground lug is not numbered but is easily recognized as an extension of the metal bracket on the outside of the jack's body just above lug 2. Solder the two BLACK wires from the speaker and the AUDIO OUT to this ground lug.

❑ ❑ 7-31. Solder the WHITE speaker wire to lug 7 of the jack.

Figure 7.3



❑ ❑ 7-32. Referring to Figure 7.3, solder the RED wire from "Vcc Ext" to the (+) lug of the DC connector.

❑ ❑ 7-33. Referring to Figure 7.3, solder the BLACK wire from "Vcc Ext" to the (-) lug of the DC connector.

❑ ❑ 7-34. Mount the toggle switch on the front panel noting that the locking tab in the smooth washer mates the small panel hole beneath the switch hole. The smooth washer goes on the front side of the panel. Be careful not to scratch the panel when tightening the hex nut.

❑ ❑ 7-35. While the switch is a DPDT type, only an SPST arrangement is used to turn the receiver on and off. (Later, you may decide on a practical function for the unused pole, such as grounding an antenna when the switch is in the "off " position.) Solder one red wire from the "Power Switch" box on the board to either of the BOTTOM switch lugs.

❑ ❑ 7-36. Solder the other red wire from “Power Switch” to the switch lug immediately above the wire installed in step 7-35.

❑ ❑ 7-37. Slip a #10 solder lug over the shorter of the two #10 screws and pass the screw from within the chassis through the GROUND hole of the rear panel. Then slip on a #10 lock washer and a #10 hex nut. Tighten the nut all the way. Add two #10 flat washers and one #10 wing nut to complete the ground terminal. for easier soldering, bend the solder lug away from from the panel slightly, using a screwdriver or knife blade.

❑ ❑ 7-38. The Antenna terminal is assembled similar to the ground terminal except that it is insulated from the panel by the two matching insulator sections. Slip the other #10 solder lug and one insulator on the larger #10 screw, pass it through the panel, add the other insulator, lock washer and hex nut. After tightening the nut, add the two #10 flat washers and wing nut.

❑ ❑ 7-39. Pass the coax from the receiver board back under the board and solder the center conductor to the antenna terminal solder lug. Solder the outer shield to the ground lug.

❑ ❑ 7-40. **DC Power LED1 Installation:** This LED needs to be firmly secured to the front panel with its longer anode lead carefully insulated to prevent shorting to the bare aluminum subpanel. Our normal factory method for mounting an isolated LED is to apply a tiny drop of clear fast-dry glue to bond the LED body to the inside of the front panel. If gluing is not practical for you, the LED could be held in position by shaping a wedge from easily-worked material such as styrofoam, cardboard or foam rubber and pressing it in place between the LED and the sub-panel. The anode lead can be insulated with a layer of electrical tape or by stripping a length of insulation from extra hookup wire and sliding it over the anode wire.

❑ ❑ 7-41. Mount LED1 and insulate its anode lead as explained in step 7-40.

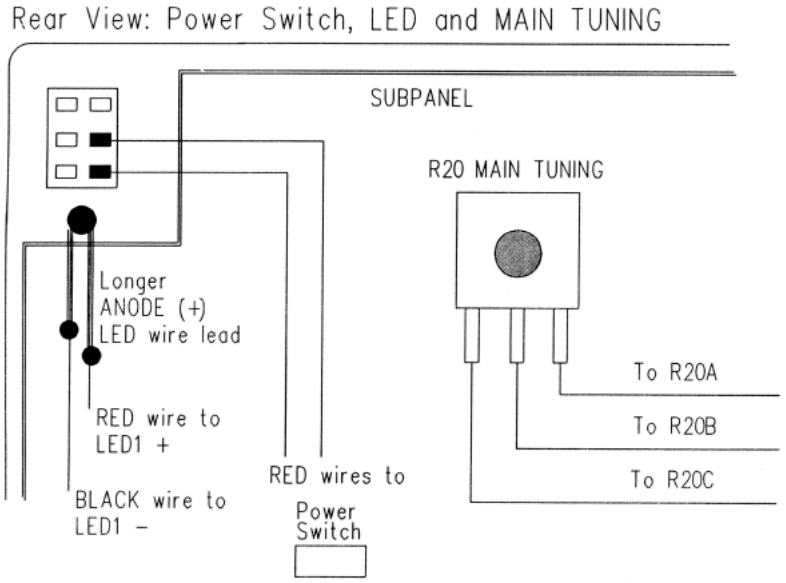


Figure 7.4

❑ ❑ 7-42. Solder the RED wire from "LED1" on the receiver board to the insulated ANODE (longer) lead of LED1.

❑ ❑ 7-43. Solder the BLACK wire from "LED1" on the receiver board to the remaining CATHODE lead of LED1.

❑ ❑ 7-44. Secure the two long speaker wires at their midpoint with a cable tie.

❑ ❑ 7-45. Gather the six wires to "Vcc Batt," "Vcc Ext" and "AUDIO OUT" and bundle them with a cable tie about 1" from the "Vcc Batt" connections on the board.

❑ ❑ 7-46. Attach the last cable tie around the four wires to the battery shelf assembly and external DC power jack, positioning it about 1.5" from the cable tie installed in step 7-45.

❑ ❑ 7-47. If you did not do so already, mount the 1/4" phone jack on the rear panel, with the flat washer between the panel and nut.

At this point, all receiver wiring is completed, and you are ready to make the only final adjustment required, a careful setting of the R6 regeneration trimmer. Do NOT mount the battery shelf assembly yet, as it would block access to the R6 trimmer.

❑ ❑ 7-48. Use the correct size allen wrench to install all front panel knobs, if you have not done so already. The alignment of knob stripes to front panel markings should be very obvious. Make sure the Main Tuning knob has clearance from the front panel and does not rub against it.

❑ ❑ 7-49. Prepare the receiver for testing as follows:

- ❑ Set DC power switch to OFF: install 8 "C" cells in battery shelf assembly OR connect 12-15VDC to the rear panel.
- ❑ Connect antenna wire to rear panel antenna terminal.
- ❑ If the antenna feedline is coax, connect the shield of the feedline to GROUND. If not, it may be necessary to make an earth ground connection to GROUND in order to properly evaluate higher-frequency performance.

❑ ❑ 7-50. Turn the receiver ON and observe that LED1 near the switch is on, and ONE bandswitch LED is on. Press the band-switch through its entire 9-band cycle to confirm correct operation. REVIEW the tests done in Phase 4 to re familiarize yourself with R6 trimmer adjustment.

❑ ❑ 7-51. With the front panel regeneration control at its midway position, advance the bandswitch to 17/16 Meter Band and check for the presence of regeneration or actual signals. If you DO hear regeneration, make sure you can hear it no matter where you turn the Main Tuning knob, even if you must re-adjust the front panel regeneration control several times through the range of the Main Tuning.

❑ ❑ 7-52. If you did NOT hear regeneration on the 17/16 Meter Band per step 7-51, slowly adjust R6 from its clockwise position until you get the results described in step 7-51 .

❑ ❑ 7-53. Advance the bandswitch to the 15/13 Meter Band. Realize first that this band covers the extreme high range of this particular receiver design. Adjust R6 as needed so that you detect regeneration throughout the Main Tuning range; frequent adjustment of the front panel Regeneration control will be needed.

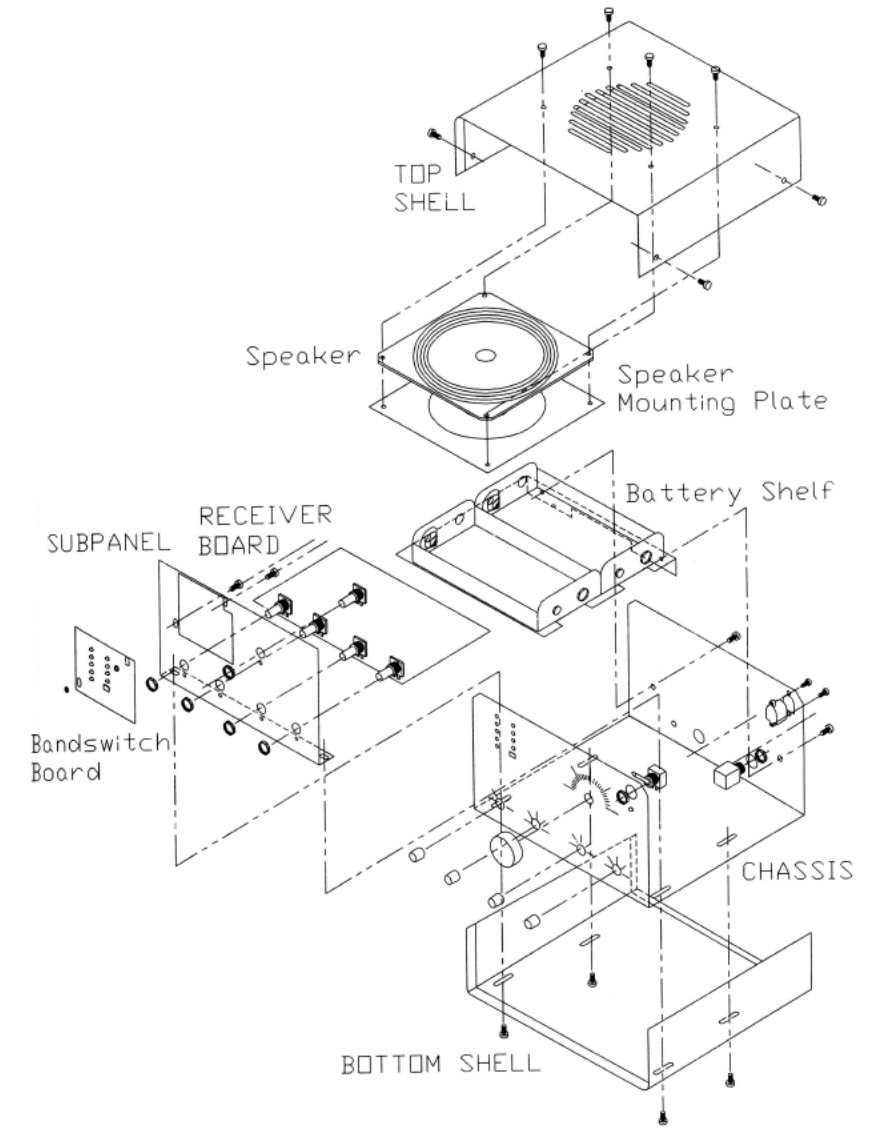
❑ ❑ 7-54. Reset the bandswitch system to Band 1 (160 meters). Verify that regeneration starts as you rotate the front panel control from its far left (counterclockwise) position. You will hear actual signals mostly during fall/winter evenings unless you live in a coastal area with nearby navigation beacon signals.

❑ ❑ 7-55. In brief: adjust trimmer R6 so you can experience regeneration on all bands, realizing that turning Main Tuning or changing RF Gain control setting can require frequent touching up of the setting of the Regeneration control.

❑ ❑ 7-56. When you become satisfied that the regeneration system works on all 9 tuning bands, turn DC power OFF.

❑ ❑ 7-57. If you have any concern about whether you wired correctly the 1/4" stereo phone jack, check it out NOW before installing the battery assembly. Turn the receiver on and adjust control as needed to hear something, anything! Plug in any set of stereo or mono headphones and listen -- to ensure that the headphones are active and that the speaker is muted (silent). (If no headphones are handy, ANY 1/4" plug can be inserted to verify cutting off of speaker audio.)

Figure 7.5
General View of 1253 Receiver Assembly



PHASE 7.0: FINAL ASSEMBLY STEPS

❑ ❑ 7-58. Attach the battery shelf assembly to the rear panel using two #4 self-tapping screws inserted from the back end of the rear panel. (This procedure is done MUCH more easily without the weight of batteries.)

❑ ❑ 7-59. Re-install the 8 "C" cells, if desired.

❑ ❑ 7-60. Attach the 4 self-stick rubber feet to the four corners of the bottom shell, making allowance for all slots to accommodate screw heads from the panel/chassis section.

❑ ❑ 7-61. Set the receiver chassis/panel assembly into the bottom shell prepared in step 7-60 above.

❑ ❑ 7-62. Check ALL wires and cable-tied groups to make sure they are not jammed tightly against hardware or parts.

❑ ❑ 7-63. Secure the top shell with speaker to the bottom shell with the four short #6 sheet-metal screws.

❑ ❑ 7-64. Turn the receiver on, simply to ensure proper operation of the bandswitch button. If the band switching behaves erratically or not at all, this is an indication that the subpanel is mounted too far forward, or that the front panel is being bent back by the main tuning knob being mounted too close to the front panel, or that the top shell is not aligned correctly. Adjust as needed.

These steps for Phase 7, followed exactly and in order, complete the assembly of the T-KIT 1253 Shortwave Receiver. When or if necessary, the receiver can be disassembled by following these same steps in reverse order.

Be sure to study the following explanations of all controls and connections to achieve maximum understanding and enjoyment of the receiver. Especially, make certain to familiarize yourself with the use of the Regeneration and RF Gain controls.

Receiver Controls and Connections

Most of the control functions are obvious. However, it is especially important to understand the correct use of the RF Gain and Regeneration controls and the one internal trimmer adjustment of the receiver set in Phase 7.0.

Bandswitch Button
This switch advances to the next band up each time it is pressed, as indicated by the corresponding LED. When the receiver is first turned on, it is typical for the LED for Band 1 to light. If power is turned off or lost for a few seconds, the band which was in use generally comes back on (depending on how quickly C32 discharges).

RF Gain Control (R1)
Maximum gain is NOT always best. You will find in practice that adjusting this control as needed will greatly affect reception clarity. Maximum gain is clockwise. A good normal setting is 3/4 of its full rotation. If you are using a marginal antenna (5 to 10 feet of wire indoors), keep R1 at its maximum setting. If you are using a very good antenna (a long, high outdoor wire or ham antenna), adjust RF gain for best reception. Less is often better, because the regenerative detector is extremely sensitive and can be overloaded by strong signals to the extent that the RF gain control behaves more like a regeneration or tuning control. A good practice is to turn R1 back to the point where it stops changing the receiving frequency.

Regeneration Control (R5)
Because understanding and controlling regeneration is at the heart of your receiver's performance, we've provided a separate section on its use. In brief, it controls receiver sensitivity and adjusts between AM broadcasts and CW-SSB.

Main Tuning (R20) and Logging Scale
The Main Tuning control, a 10K potentiometer (R20), varies the voltage applied to the MV209 varactor. The "logging scale" imprinted on the front panel helps you keep notes on where on the dial you find stations of interest (see sample logging sheet in this manual). As you become used to this classic method of receiver tuning, it becomes second nature, and you'll find your favorite stations or bands easily.

Fine Tuning Control (R21)
This control is especially helpful in tuning CW and SSB signals.

DC Power Switch
While the purpose of the on-off switch is obvious, do remember to turn your receiver OFF when not in use. Weakened batteries will degrade receiver performance.

Volume (R17)
This potentiometer performs the normal function of any volume control. For AM international broadcasts, and to conserve battery life, you'll rarely need more than half of the available gain offered by the TDA2611A audio IC.

Headphone Jack (J1)
This jack accepts standard 1/4" stereo or monaural plugs typical of standard communications headsets. To use "Walkman" type stereo headphones or mini-speaker systems, use a 1/4" stereo to 1/8" stereo adapter such as Radio Shack™ No. 274-367. This jack may also be used to connect an external speaker (4 to 8 ohms) of any size or power rating you wish. wired correctly during kit assembly, the jack disconnects the receiver's internal speaker when a plug is inserted. R28 and R29 slightly reduce the audio level to the headphones and prevent monaural plugs from causing a direct short to ground.

Antenna Terminal
The antenna wire (or feedline) is attached between the two flat washers before tightening 10 to 20 feet of ordinary hookup wire (also called "bell wire") provides good basic reception, even when installed indoors. See the section on Antennas in this book for more information.

Antenna Ground Connection
For casual listening to strong broadcast signals, a ground connection is optional. However, a wire from this connector to a ground rod or cold water pipe will reduce unwanted noise and interference from nearby electrical devices or AC wiring and may boost receiver sensitivity. You will find the ground connection to be essential for reception above 9 or 10 MHz unless you are well away from household AC wiring.

External 12-14 VDC Connection
This DC voltage connection for the audio amplifier circuit permits the use of a wide variety of DC power sources. Some DC wall adapters may work well, depending on their design Keep in mind that some wall transformers only provide AC output voltage - you MUST use a unit with 12 to 15 volts DC output.

Using & Understanding the Regeneration Control

In theory, your receiver's Regeneration Control adjusts the level of feedback or self-oscillation of the FET detector section (Q2). In practice, this control is like a "joystick" for optimizing receiver performance. Your ability to handle this "joystick" saves you many dollars over today's cost of receivers which perform similar functions "automatically." You might even get more control over receiver performance in varying situations than may be possible with more expensive receivers. Once you know how to use it, it's a fun control!

With the control turned fully to the left (counter clockwise), the receiver is virtually silent. "Regeneration" begins at a certain point as you turn the control clockwise. The exact point varies not only from band to band but even as you tune within a given band. Regeneration begins as an audible increase in background noise followed by a soft hiss. The hiss, or any signals that may be on frequency, increases as you continue to turn clockwise. If you go too far, the signal becomes distorted, or the receiver begins to squeal (oscillate).

Always use the LEAST amount of regeneration necessary for good reception of a given signal. The best reception of AM shortwave broadcast signals occurs just before regeneration begins. If you hear a whistle (carrier) along with an AM signal, turn the control back slightly until the carrier disappears.

When there are many very strong shortwave AM broadcasts in a given band, such as is common in the early evening,. you will find it possible to tune them in one after the other with the regeneration control set "way back" and requiring virtually no adjustment. In other words, you would tune from station to station just as if using any other type of shortwave set.

When the receiver is adjusted for good AM reception, CW signals will sound like hisses. Advancing the regeneration control slightly will bring in the familiar beeping associated with CW, RTTY (radio teletype) or similar signals.

The regeneration control can also serve as a fine tuning control, permitting slight adjustments of CW pitch for the most pleasing sound, or best clarity in a SSB voice signal. After you've had some practice with using the regeneration control, it will become second nature, giving you a sense of real control over the performance of your receiver.

About the 9 Tuning Bands of your 1253 Receiver . . .

The following tuning ranges are typical but can vary +5% due to manufacturing tolerances of the inductors and capacitors in the bandswitching circuits. Notice that the bands begin to overlap each other above 8 MHz. Rather than trying for continuous tuning with no "gaps," our main goal was to make sure that the most popular bands are covered easily.

■ Band 1: 1.760 to 1.990 MHz.

This tuning range includes the most active segment of the 160 meter amateur band, 1.8 to 1.9 MHz. This band is very active at night during the winter, with year-round SSB regulars chatting with their local or regional friends just before dawn. If you live near a coast or other busy waterway, You also may hear beacon signals for navigation.

■ Band 2: 3.3 to 4.150 MHz.

This range provides full coverage of the always-popular 80 and 75 meter amateur radio bands, 3.5 to 4.0 MHz. Traditionally, the 3.5 to 3.75 MHz half (CW, RTTY, packet, etc.) is called 80 meters, while the 3.75 to 4.0 MHz SSB voice section is called 75 meters. Like 160 meters, this band is most active between sundown and dawn, but it is busy year-round.

■ Band 3: 5.5 to 6.9 MHz.

The main purpose of this tuning range is to give you lots of strong shortwave broadcasts in late afternoon through early morning on the 49 meter band, 5.95 to 6.2 MHz. Many other transmissions also can be heard in this tuning range.

■ Band 4: 6.8 to 8.5 MHz.

The popular 40 meter amateur band is 7.0 to 7.3 MHz, with many evening AM broadcasts among the ham CW and SSB signals. Look for station CHU, the Canadian national time signal at 7.335 MHz. Unlicensed “pirate” broadcasters can sometimes be spotted around 7.4 MHz.

■ Band 5: 8.5 to 11 MHz.

This band lets you tune all of the popular 31 meter broadcast band, 9.5 to 9.9 MHz. You can also find the WWV time signal at 10.0 MHz (or on Bands 7 and 8 at 15.0 MHz.) The 30 meter ham band (CW and RTTY only in the USA) is at 10.1 to 10.15 MHz. This tuning range is generally busy 24 hours a day.

Band 6: 10.1 to 13.2 MHz.

Among the numerous transmissions in the 3 MHz range are strong daytime worldwide broadcasts of the 25 meter band, 11.65 to 12.05 MHz.

Band 7: 12.5 to 16 MHz.

On the 20 meter amateur band (14.0 to 14.35 MHz), you can hear strong CW and SSB voice signals from around the world throughout the day and well into the evening. Usually, this is the most active and crowded of the international ham radio bands. You also are able to tune the 21 meter shortwave broadcast band (13.6 to 13.8 MHz), and all of the 19 meter band (15.1 to 15.6 MHz). Station WWV at 15.0 MHz provides precision time and frequency information.

Band 8: 14.7 to 18.5 MHz.

Especially during daylight hours, look for worldwide 16 meter broadcasts on 17.55 to 17.9 MHz and the 17 meter amateur band, 18.068 to 18.168 MHz Numerous other commercial and government signals can also be heard.

Band 9: 18.5 to 21.5 MHz.

Also a “daytime” tuning range, this highest band is provided to permit tuning of the 15 meter amateur band, 21 to 21.45 MHz. Depending on component tolerances, the receiver may tune some or all of the 13 meter broadcast band, 21.45 to 21.85 MHz. This tuning range is near the outer limits of useful frequency coverage by this type of receiver circuit.

Shortwave Listening in General

In addition to the specific “bands” highlighted above, you'll hear thousands of OTHER shortwave signals. Many will be military or government morse code transmissions, plus very “odd” noises of weather FAX, wire service and other data transmissions. You can also hear government or military SSB voice transmissions and even an occasional unlicensed “pirate” station. A rule of thumb is that the lower frequency ranges (1 to 5) are most active during the late afternoon, evening and through the night. The higher frequencies (6 to 9) generally are most active during daylight hours. Make your own copies of the sample **Shortwave Listening Log** to keep track of your radio listening experiences.

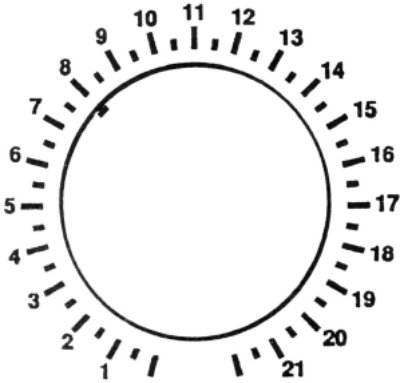
About the Receiver
LOGGING SCALE

The "frequency display" of any communications equipment, whether a mechanical dial or a digital-readout, is its costliest single design feature. We chose the "Logging Scale" approach to the calibration of the 1253 receiver because it is a proven method of accurate frequency-finding each time you use the receiver. Obviously, there is no room on the front panel to provide attractively any frequency information about NINE different bands.

A classic example of practical logging-scale receivers used in very serious situations is the National Radio "HRO" series of receivers used throughout WWII. Even though some other receivers had dials with frequency markings, the "HRO" was a marvel of technical precision with its mechanical-digital 0-500 readout used in conjunction with frequency charts.

Frequency dials work well if there is some way to adjust a receiver's components to match the dial. Other than the adjustment required for R6 (regeneration trimmer), the 1253 receiver is designed to not require adjustment of variable coils or capacitors for each band, the process called "alignment."

In addition to the sample Short Wave Listening log page provided in this manual, we also provide the blank "Calibration Chart" on the following page. You may wish to make extra copies of this page before writing on it. In the spaces provided, make notes of known frequencies which correspond to any given Bandswitch and Main Tuning combination.



In fact, you can use a separate general coverage receiver or ham transceiver to listen for the 1253 receiver's oscillator signal and then create a very detailed frequency chart for your receiver. An accurate signal generator can be used for the same purpose, listening for its RF signal to the 1253 receiver and making notes on the chart.

Model 1253 Band/Main Tuning Calibration Chart

DIAL	1	2	3	4	5	6	7	8	9
1.0									
1.5									
2.0									
2.5									
3.0									
3.5									
4.0									
4.5									
5.0									
5.5									
6.0									
6.5									
7.0									
7.5									
8.0									
8.5									
9.0									
9.5									
10.0									
11.0									
12.0									
13.0									
14.0									
15.0									
16.0									
17.0									
18.0									
19.0									
20.0									

Setting up a Shortwave Listening Antenna

Your receiver is so sensitive that even a few feet of wire strung indoors will provide reception of stronger signals, particularly at night. 20 to 30 feet of wire is much better. Therefore, you can count on good reception even if you are limited to keeping the antenna indoors as might be required in apartments, etc.

Stringing all or part of your antenna outdoors is always better. An ideal antenna for this receiver would consist of 25 to 100 feet of wire outdoors, as high as is safely possible. Such antennas are called "random long wires" and also work fine in most attics. (Foil-backed insulation or metal roofing will reduce the usefulness of an attic as antenna space.)

Your antenna can be horizontal, vertical or a combination of both. It can be tubing or pipe as well as wire. The wire can be bare or insulated. It could be something not intended to be an antenna at all, such as a gutter, fence, flagpole or metal roof.

A shielded coaxial cable feedline to the antenna such as RG59 or RG59 is NOT essential but may prove helpful in eliminating or reducing hum or buzz from nearby electrical wiring, especially when the receiver is operated from a power supply. The coax shield is connected to the receiver Ground terminal.

Even if not using a coax feedline, a wire from the Ground terminal to an earth ground rod or cold water plumbing (metal, NOT plastic) can reduce AC interference and improve reception. The grounding wire should be as short as possible.

CAUTION:
Use care and common sense when putting up outdoor antennas. Be certain that your wires or your ladder cannot come into contact with electrical power lines. You can be KILLED by accidental contact with Power lines.

IMPORTANT!
All outdoor antennas should include a way to switch the antenna away from radio equipment to ground during thunderstorms. It does Nor take a direct lightning hit to damage this receiver or other equipment. If the receiver remains connected to an antenna during a storm, lightning strikes a mile away can burn out parts, particularly transistor Q1 in the 1253 receiver.

Tuning SSB (Single Sideband) Voice Signals

SSB signals are those voice signals which sound like Donald Duck unless they are tuned in properly. They have no background carrier as do AM broadcast signals. On modern ham radio transceivers, tuning SSB is made so easy by by internal filters that many licensed ham operators are not aware of the basic technique for tuning in SSB signals on receivers without such filters.

The first fact to know about any given group of SSB signals is whether they are Upper (USB) or Lower (LSB) Sideband. In ham communication, LSB used on 1.8 through 7.3 MHz, and USB is used for higher frequency bands (14, 18, 21 , 28 MHz.)

Think to yourself: for LOWER sideband, tune DOWN.
For UPPER sideband, tune UP.

This means you would "approach" the LSB signal by tuning from higher frequency (right) to lower (left), from higher voice pitch to lower. Here's how, step by step:

1. Pick out a strong, high-pitched Donald Duck voice.
2. Turn the Fine tuning knob ever so slightly to the left.
3. If the pitch of the voice went DOWN slightly, you're heading in the right direction.
4. SLOWLY tune left slightly more until the voice is clear.

Reverse this process to tune to UP (to the right) to USB signals on the bands above 40 meters. The Regeneration control often can be used to do the last touch of fine tuning to bring the voice in clearly. If signals are exceptionally strong, it may be necessary to reduce RF gain.

SSB transmissions also are used by embassies, international airlines agencies of various governments, so you might find interesting voice signals on other than ham frequencies. Check with an experienced Shortwave Listener (SWL) or listings in popular Communications Magazine (available at newsstands) for more details.

Troubleshooting Guide

This receiver will work as specified if the right parts are selected and installed correctly and all connections are made as explained in this manual . The #1 cause of problems in most kit projects is exactly the things we tend to take for granted: a mistake or broken wire in the connection of external items to the circuit board, such as DC power, speaker, switches and so forth. After that comes a mistake on the board itself, such as:

- ❑ Incorrect part value
- ❑ Reversed orientation of transistors, capacitors, etc.
- ❑ Bad solder connection (cold joint or bridge)

If your receiver does not work, review ALL construction steps carefully. Let somebody else go over your work and the steps. Here is a guide to minor problems which are easier to solve:

1. Weak volume with headphones. *Test your headphones on a working stereo: it is easily possible for headphones to become defective. Also, remember that the audio output is designed for low impedance headphones (8 ohms typically) and poor results might be expected from some high impedance magnetic phones.*

2. CW signals all sound chirpy or wobbly.
The batteries are much too weak: check and replace.

3. Regeneration inoperative on some bands, especially Band 1 or Band 9. *Incorrect adjustment of trimmer R6. See Steps 7-51-54.*

4. Receiver works fine sometimes, but is erratic especially when it is bumped or moved. *Look for a loose solder connection.*

5. Very strong signals are impossible to tune in well.
Reduce the setting of the RF Gain control.

6. Signals wobble slightly if the receiver is bumped.
This is a normal characteristic of ANY simple oscillator.

7. The tuning bands seem mixed up, such as 80 and 20 meters reversed. *Incorrect installation of inductors: for example L2 for 80 meters is 33 µH (orange-orange-BLACK-gold) and L7 for 20 meters is 3.3 µH (orange-orange-GOLD-gold).*

8. Extreme squealing or buzzing at higher settings of volume control. *This "feedback" indicates an error in kit assembly. Recheck all assembly steps. (Slight feedback may begin to occur with extremely weak batteries.)*

9. Erratic bandswitch operation; bands change when receiver is bumped. *The subpanel is mounted too lightly against the front panel putting pressure on the switch. Move the subpanel as needed to correct the problem.*

Experimenting with 1253 Receiver Modifications

Radio amateurs and electronics hobbyists are just like car buffs and many other hobbyists -- ever tinkering with and customizing their equipment, regardless of whether it is factory-built or kit-built. This was quite common in the decades before the typical ham transceiver became an expensive, imported box tightly-packed with sub-miniature components. We are well aware that the roomy, straightforward design of the 1253 receiver virtually invites creative tinkering and perhaps genuine enhancement. We've seen enough magazine articles over the decades about minor modification of TEN-TEC equipment to expect this. We encourage you to make sure the receiver is working as designed before trying any changes.

You may try building a power supply on the battery shelf in place of the "C" cell holders. Be prepared for possible AC hum from the transformer which no amount of filtering may solve. A better approach could be an external wall transformer with proper filtering built on the battery shelf. You may wish to change band coverage characteristics by adding small-value (pF) capacitors in the board positions conveniently provided for "C35-C42.'" You may choose to replace the insulated antenna terminal assembly with some sort of coaxial connector. Or, add an active antenna circuit and telescoping whip for portability.

Please understand that chatting about modification ideas is beyond the purpose of T-KIT Technical Assistance.

Conclusion

If you enjoy shortwave radio listening, you'll soon yearn for and then get or build a more elaborate receiver. You might even work on getting a ham radio license and setting up a station for transmitting and receiving. As the years go by, we have a hunch that you'll always remember the first thrills of building and listening to your T-KIT 1253. And, because it's compact and far more sophisticated than the first receivers of yesteryear, we suspect you'll actually keep it and keep on listening to it when nobody else is looking!

LEARNING MORE . . .

One purpose of your Receiver and the details provided in this instruction manual are to help you become better acquainted with radio communications and electronics . . as a hobby, as a possible profession, or both.

As suggested in the Introduction, this receiver design incorporates many if not most of the basic circuit building blocks used in communications equipment:

- ✔ RF amplifier
- ✔ RF oscillator
- ✔ Varactor tuning
- ✔ Resonant L-C circuits
- ✔ Buffer-amplifier
- ✔ Audio preamplifier
- ✔ Integrated audio amplifier
- ✔ Integrated voltage regulator
- ✔ Digital logic IC

So, the better you understand how this receiver works, the more you learn about modern electronics!

Among the hundreds of publications available, We are pleased to recommend the following as especially helpful for radio newcomers and people of any age who are young at heart!

___*Getting Started in Electronics*
by Forest Mims III (Radio Shack™)
___*Now You're Talking: Discovering the World of Ham Radio*
(ARRL, Newington, CT 06111, also sold by Radio Shack™)

Or, if you just want to try a single copy of one magazine that's all about ALL the signals you may hear on your T-KIT 1253, you can find the latest issue of *Popular Communications* at many magazine stands. It's an intriguing publication. Happy listening!

THANKS for your interest in T-KIT by TEN-TEC!

APPENDIX:
Notes for Hams,
Club Leaders, Teachers, Engineers, etc.

A *regenerative* circuit for a 1990's SWL receiver? This is a fair concern which we ourselves have debated, but the T-KIT 1253 is not like any regenerative receiver you've ever bought or used before! We wanted these features:

- ✔ GOOD reception of BOTH shortwave AM and CW-SSB
- ✔ Ease of kit-construction for newcomers
- ✔ An attractive price
- ✔ A quality look and feel
- ✔ No critical alignment requirements
- ✔ Serious attention to AUDIO circuit
- ✔ Low parts count, yet not dependent on specialty IC's
- ✔ Purposeful choice of tuning ranges for SWL-ing anytime.

Satisfactory AM-CW-SSB listening and circuit simplicity were our primary goals. Despite the popularity of the "direct conversion" circuits re-pioneered among hams by TEN-TEC in our first years, direct conversion is NOT satisfactory for **enjoyable** listening to AM shortwave broadcasts. Merely nulling the carrier does not result in true listenability. Similarly, a multi-band superhet with BFO cannot fit our goals of economy and simplicity.

To meet our goals, we adapted a more contemporary design approach to regeneration plus sophisticated yet simple bandswitching and maximized audio output. Our main goal was to help even beginners enjoy and understand the use of Regeneration while also experiencing audio strength and quality taken for granted in today's consumer electronics. The result is an HF SWL receiver with better performance than some low-end superhets of yesteryear – but still at yesteryear's kit prices!

This manual is addressed to electronics beginners of all ages, but it is written in the hope that a knowledgeable radio amateur ("Elmer"!) may be looking over the kit-builder's shoulder!

Supplementary Circuit Discussion
(see also page 6-7 and schematic on pages 32-33):

In brief, the circuit uses RF regeneration and high levels of DC feedback. Notice that the antenna is coupled directly to the drain of RF amplifier FET Q1 rather than through the L-C tuning network. Direct coupling of the drains of Q2 and Q3 isolates the L-C circuit from the antenna input, enhancing stability and greatly minimizing RF oscillator output to the antenna. Such RFI was a significant problem in traditional regenerative circuit which permitted the oscillating detector to behave as an unstable but potent QRP transmitter. Adjustment of trimmer pot R6 provides for smooth regeneration over all tuning ranges, compensating for individual FET characteristics.

Simple regenerative detectors have very low-level audio output suitable only for high-impedance earphones. Boosting such audio must be done with care – the job of the Q4 preamp circuit. This 1253 design buffers the highly sensitive oscillator/detector section and uses the generous audio output capabilities of U1, the same TDA2611A audio IC used in TEN-TEC transceivers.

The 8 volt regulator U2 plus Q5 provides stable operating voltage for the oscillator, varactor and bandswitching circuits, isolating them from audio current peaks, which would otherwise cause extreme frequency instability. Q5 is an "active capacitance" circuit which multiplies the effect of C29.

Bandswitch Board: The 74HC4017 TTL decade counter IC was chosen over its CMOS 4017 counterpart because its superior current-sourcing capabilities are essential for frequency stability in the L-C tuned circuits. While the zener diode holds Vcc for U1 to proper TTL supply voltage, R2 lifts device ground above common ground to permit switching of about 8 volts through the L-C circuits. Minimal switch debouncing is required and is accomplished by C1.

Notice the unused circuit board positions for C35 through C42. We provided these in our original design in anticipation of a possible need to put a small capacitance in parallel with an inductor for a desired frequency coverage. Adding any such a capacitor LOWERS the frequency range and reduces the total tuning range of R20.

For the convenience of all kit builders, the bandswitch board is manufactured as a double-sided board with plated-through holes.

Attention Club Leaders, Instructors:

The T-KIT Model 1054 Receiver Kit
is an economical and simplified version
of this same 1253 receiver
with mechanical pushbutton switching of
4 bands between 5 and 15 MHz.
The audio IC is LM386; good stability is achieved by using separate batteries for the detector/varactor circuits and the audio circuit. We provide a good-looking front panel, and the kit builder supplies knobs, cabinet, speaker, wire and other hardware items.

Shortwave Listening Log

Page _____ Receiver _____ Antenna _____

Operator _____ Location _____

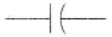
Date	Time UTC	Tuning Dial	Freq. MHz	Mode AM-CW-SSB	Signal Report	Call Sign or Broadcast notes, QSL address

T-KIT Electronic Parts Identification Guide with Schematic Symbols

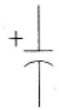
If your kit also includes parts not illustrated below, consult this manual for detailed description or illustration

Resistor

Ceramic disc capacitor



Electrolytic capacitor



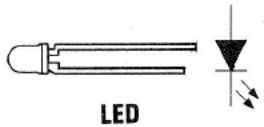
Mylar film capacitor

Molded inductor

Trimmer potentiometer

Diode

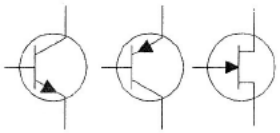
Varactor diode



LED

Transistors (TO-92 case)

NPN PNP FET



Transistor or Voltage Regulator (TO-220 case)

Other parts and symbols are illustrated in electronics catalogs and handbooks.

T-KIT Limited Warranty

Please read carefully BEFORE building your Kit

This limited warranty applies solely to KITS sold by TEN-TEC, Inc. under the trade name :T-KIT". The terms of this warranty do not apply to other products of any kind manufactured by TEN-TEC Inc., nor shall any other warranties published by TEN-TEC Inc., or any TEN-TEC customer service policies for its manufactured products, be construed as applicable to T-KIT products.

1. *All components and hardware supplied as parts of a kit are warranted to be free from manufacturing defect for one year from date of purchase.*

2. *The original purchases has the option of examining the kit and manual for 30 days. If you choose within this period not to construct the kit, you may return the entire un-assembled kit at your expense for full credit toward any other TEN-TEC product, or a refund, less original shipping/handling charges.*

3. *This warranty is voided if acid-core solder is used in construction. USE ROSIN CORE SOLDER OLY, of a grade designed for electronic PC-board assembly. WARNING, solder contain lead, which is known to cause birth defects or other reproductive harm. Avoid breathing solder fumes which may cause pulmonary irritation or damage. After handling any solder, wash hands with soap and water before eating.*

4. *TEN-TEC Inc. warrants this device to function as described in its documentation provided that it is assembled and used correctly in accord with all printed directions. It is your responsibility to follow all directions in the instruction manual to identify components correctly and to use good workmanship and proper tools in construction this kit.*

5. *We do not accept the return of partially-assembled kits for repair or refund.*

6. *If you believe a kit part is missing, do a thorough sorting of all parts, checking each off on the parts list in the manual. Check all bags, envelopes and boxes carefully. Simply call or email* service@tentec.com *and we will promptly replace any missing part. Even if you find an exact replacement part locally, please notify us so we can assist other customers.*

7. *If your kit does not work after final assembly, please follow these steps in order:*

A. Double check every step in the assembly manual and any troubleshooting tips provided.

B. Ask an experienced ham or hobbyist friend to review your work. A fresh set of eyes can catch a detail which you may have overlooked.

C. If necessary, you are welcome to call TEN-TEC service at 865-453-7172 Technical assistance is not available on the 800 Sales lines.

8. *Factory inspection and service. If you wish to return a kit for professional inspection or repair there is a minimum charge of $XXXX. There is no need to call or write for authorization, simply send your kit with a note explaining the problem and provide authorization to make repairs at prevailing ship rates.*

9. *TEN-TEC, Inc. reserves the right to revise this limited warranty, to change or discontinue any kit product or revise its instruction manual with no liability to previous purchasers.*

10. *TEN-TEC, Inc. is not liable for any consequences from use or abuse of any T-KIT or part contained therein.*

T-KITS by TEN-TEC

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