40 METER (7.0 MHZ) ALL MODE RECEIVER KIT

Ramsey Electronics Model No. HR40

*Small in size but **BIG** in features:*

- **Easily tunes SSB, CW, RTTY and AM**
- **Smooth varactor tuning of any desired 250KHz segment of the 40 meter band, easily retuned**
- **Uses the popular SA602 IC chip for outstanding sensitivity and efficient operation**
- **Front panel RF Gain, Tuning and Volume controls**
- **Efficient LM-386 Audio amplifier drives speaker or earphones with a clean, crisp audio**
- **Informative manual answers questions on receivers, hookups and uses - enhances resale value, too!**
- **Ideal companion to the Ramsey QRP-40 CW Transmitter**
- **Runs on a standard 9-volt battery**
- **Clear, concise assembly instructions lead you to a finished product that works FIRST time!**

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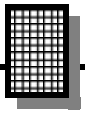
HR40 AMATEUR RECEIVER KIT INSTRUCTION MANUAL
Ramsey Electronics publication No. MHR40 Revision C1
First printing: January 1995

Ramsey Publication No. MHR40
Price $5.00



KIT ASSEMBLY
AND INSTRUCTION MANUAL FOR

HR40 AMATEUR RECEIVER KIT

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INTRODUCTION:

Our HR40 and HR80 models are thought of as “best for beginners” because Hams with a Novice or Technician licenses can operate CW in the 80 and 40 meter bands. If you like plenty of action and DX (long distance) communications, the 40 meter Ham band is the place to be. Almost 24 hours a day there’s something interesting happening on 40 meters.

These are several groups of people who will enjoy this Ramsey HR40 Receiver:

- Experienced Ham operators who want a simple extra receiver for keeping one ear on 40 meters while doing something else.
- Beginners who would like to start by listening in on one of Ham radios most active bands.
- QRP builders who want a quick, easy and reliable SA602 board kit for 40 meter projects.
- QRP builders not interested in our warranty or following our step-by-step assembly and use directions, but who want to get their hands on our most versatile receiver PC-board and parts kit for their own projects.

The Ramsey HR40 has something fun and easy for each of them.

Note To Beginners: Building the HR40 is really no harder than any of our other receivers in this series. Just follow the directions carefully. All you need to know to successfully complete this receiver is contained in this detailed manual. Enjoy your HR40 receiver.

RAMSEY HR-SERIES AMATEUR RECEIVERS:

All Ramsey Direct Conversion Receiver Kits share the same basic PC-boards and most components which are not frequency critical. However, there are enough differences among the band characteristics, desirable operating features for each band, and differences among the people who would most typically choose a particular band, that a separate instruction manual is published for each receiver.

Other circuit details which vary from band to band include the tuning range provided by the varactor circuit. “Bandspread” for favorite band segments is easy on 160 or 80 meters but requires other considerations on higher frequencies. Also, some bands appeal to QRP operators more than others, and some are better suited for portable and travel use.

Therefore, we are pleased to assure you that your manual for the HR40 receiver and the receiver circuit itself has been designed with an understanding of typical operating needs and expectations for the 40 meter band.

This receiver circuit is ideal for discovering just how simple a true "Communications Receiver" can be. That's right- there is a BIG difference between the Ramsey HR40 and other simple short wave radio circuits we can try to build.

Yet it is very easy to build. Our HR-series are by far the easiest to build of all the Ramsey kit receivers and therefore very nice for radio newcomers. Consequently, our manuals for the 40 and 80 meter receivers are written with beginners in mind, since both of these bands offer Novice and Technician privileges. The manuals for the 30 and 20 meter versions assume the general Ham radio know-how that should accompany a General Class or higher license.

ABOUT DIRECT CONVERSION RECEIVERS:

The HR40 is a "Direct Conversion" receiving circuit. There is no need for IF (intermediate frequency) circuitry. The receiver "processes" the incoming signal right at its own frequency, with no need to mix or transform it with additional internal oscillators and amplifiers running at intermediate frequencies such as 455 KHz.

The advantage of this type of receiver is that it permits tuning of CW, AM and SSB signals with no need for a separate BFO. (A BFO or "beat frequency signal oscillator" is an entirely separate oscillator circuit used in the IF "intermediate frequency" section of a superhetrodyne receiving circuit). Since this frequency is designed specifically for SSB and CW, you will also hear the carrier signal of any AM shortwave broadcast station.

The most elementary "DC" receiver consists of just an oscillator and an antenna connected to the inputs of a "Product Detector" whose tiny audio output is then amplified for listening. A product detector can be made from simple diodes, or a pair of transistors, or a dual gate FET transistor, or various IC's. The Ramsey HR40 efficiently utilizes the Signetics SA602 IC for both the tunable oscillator and the product detector circuits, giving the equivalent of seven transistors in the mixer-oscillator stages.

Advantages of any Direct Conversion receiver include:

- It is simple, and therefore economical and easy to build
- It is quite sensitive even with a simple antenna
- Its tuning oscillator could even be set up to serve directly as a transmitter VFO in a simple transceiver setup.

A common problem with DC receivers is that they are easily overwhelmed by strong AM broadcast stations from almost anywhere, whether it's your local rock and roll broadcaster, Radio Moscow or the Voice of America. Even popular classics like Heath Kit's HW-8 QRP transceiver exhibit this characteristic to a frustrating degree. Another problem with DC receivers is

called “microphonics” which is a phenomenon where almost anything in the physical circuitry of the receiver can act as a sort of microphone or audio sound pickup. Touch or bump such radios and you will hear a thump or ring in the speaker or earphones. Still another problem is that of AC line hum whenever an unregulated power supply is used rather than batteries.

The Ramsey HR40’s use of the SA602 integrated circuit chip offers a circuit configuration that is as immune as any simple superhetrodyne to the classic problems with Direct Conversion receivers. The receiver is not as easily overloaded by the VOA or Radio Moscow broadcasts, and there are few annoying ”microphonics” or incurable AC hum.

Circuit Description:

U1 combines a double-balanced active mixer and oscillator in a single 8-pin IC chip. L1 peaks the RF input to pins 1 and 2 of U1. L2, with varactor diode D1 and R2, C1, C2, and C4, control the resonant frequency of U1’s internal oscillator. Rotating R2 gives about a 250 KHz tuning range. The audio output is fed from pins 4 and 5 through R3 (volume control) directly to the LM 386 audio amplifier. R1 controls RF gain. C9 boosts the gain figure of the LM 386 from 20 to 50.

PARTS SUPPLIED WITH THE HR40 KIT:

CAPACITORS:

1 .001µF disc capacitor [marked 102, .001 or 1nF] (C3)
3 100pF disc capacitor [marked 100 or 101K] (C1,C2,C4)
3 .01µF disc capacitor [marked 103 , .01 or 10nF] (C5,C6,C7)
2 4.7 to 10µF electrolytic capacitor (C8,C9)
3 100-220µF electrolytic capacitor (C10,C11,C12)

RESISTORS:

3 10K ohm potentiometers (R1,R2,R3)
1 270 ohm resistor [red-violet-brown] (R4)
2 10K resistors [brown-black orange] (R5,R6)

INDUCTORS:

1 Shielded Coil [K6883 or K6886] (L2)
1 Antenna input transformer [marked 421F-123] (L1)

SEMICONDUCTORS:

1 1N4002 Diode [black epoxy style] (D1)
1 SA602 IC (U1)
1 LM386 IC (U2)
1 6.2 volt Zener Diode [small glass body] (D2)

HARDWARE AND MISC:

1 Drilled printed-circuit board
1 9-volt battery hold-down bracket
1 9-volt battery connector
1 RCA-style jack [antenna connector] (J1)
1 subminiature earphone jack (J2)
1 PC mount pushbutton switch (S1)

REQUIRED, NOT SUPPLIED:

9-volt battery (alkaline or heavy duty type)
Earphone, or small speaker
Antenna and suitable cable

OPTIONAL:

Ramsey Electronics Case and Knob Kit, Model CHR or;
Your own choice of enclosure and hardware

"LEARN-AS-YOU-BUILD" ASSEMBLY STRATEGY:

To help you learn just what exactly is going on we'll discuss the purpose of most of the components or groups of components as we go along. Since we are trying to keep assembly of the board simple, we will not be able to fully describe each individual component's function as you build, but Ramsey's "Learn-As-You-Build" kit assembly philosophy still stands.

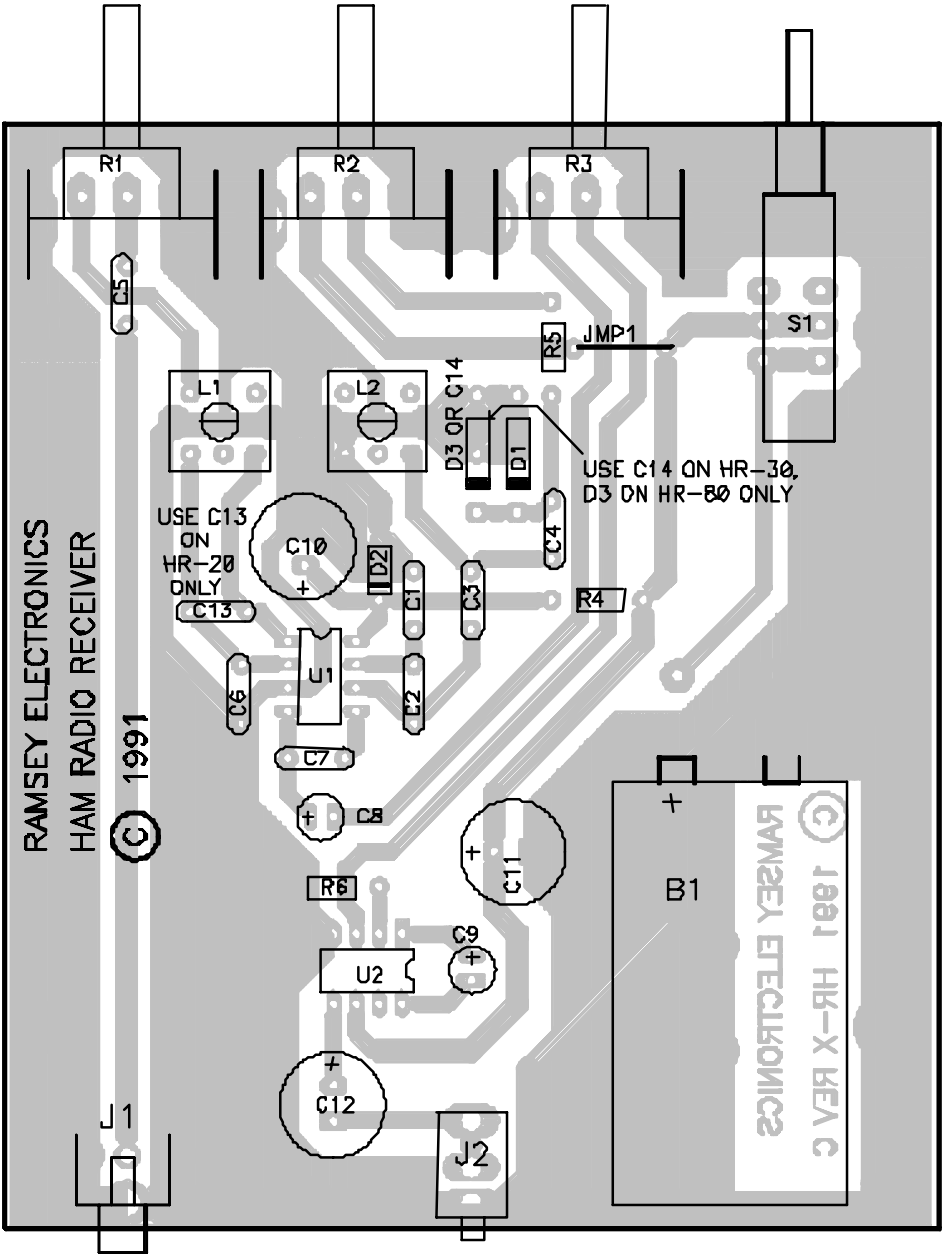
Check off each step as understood and completed. Examine the schematic diagram and PC-board X-ray illustration as you proceed. In all steps, "install" means to insert into the correct PC-board holes, solder properly, and trim all excess component leads.

Use good soldering skills - let your soldering iron heat each connection wire so that the wire itself and the foil trace both become hot enough together to melt the applied solder so that it flows smoothly around the wire lead and on to the PC board trace.

Mount all electrical parts on the top side of the board provided. This is the side that has no traces or pads on it. When parts are installed, they are placed flat to the board, and the leads are bent on the backside of the board to prevent the part from falling out before soldering. The part is then soldered securely to the board, and the remaining lead length is then clipped off. The clipped off leads should be saved for later use as jumper wires.

As you can see in examining the circuit board and parts there are many tall components such as the potentiometer, capacitors, and switches along with a lot of small parts. First you will install the larger components so they can be used as markers. So that you don't spend extra time "troubleshooting" we strongly recommend that you follow the assembly strategy and step-by-step procedures we have provided.

PARTS LAYOUT:



RECEIVER ASSEMBLY:

- ❒ 1. Install the RCA antenna jack, J1. Solder all four points.
- ❒ 2. Install C5, a .01µF ceramic disc signal coupling capacitor. This capacitor brings the signal up to the front of the PC board. Notice the long PC trace from J1 through C5 to R1
- ❒ 3. Install potentiometer R1, the RF gain control. Insert it into the PC board so that it seats firmly and is straight and even. Solder the three pins and the two mounting tabs.
- ❒ 4. Install L1(marked 421F-123), which tunes or preselects the signal input from the antenna through C5 and R1
- ❒ 5. Install U1, the SA602 IC mixer-oscillator. The marked end of the IC (band or dot) must face the FRONT of the PC board. If you wish, install an 8-pin DIP socket, still remembering to orient and install the SA602 correctly. Please don't be afraid to solder U1 directly to the board as we have seen more repair problems with DIP sockets than from direct soldering of IC chips.

The parts that we have put in so far bring the signal from the antenna jack up to the RF Gain control (actually the RF attenuator) and to a tuned circuit composed of L1 and its internal capacitor. Inductor L1 allows us to match and tune the 40 meter band signals to the SA602's input.

- ❒ 6. Install C6, .01µF (marked 103, .01, 10nF). This capacitor bypasses pin 2 of the SA602 to ground. Bypass means to provide a nice low impedance (impedance means AC resistance) path to ground.
- ❒ 7. Install R4, 270 ohms (red-violet-brown), which drops the 9 volt battery supply to 6-7 volts, safe for the SA602.
- ❒ 8. Install D2, 6.2 volt Zener diode. This is the smaller of the two diodes and has a painted glass body. This diode acts as a voltage regulator by keeping the voltage across it constant.
- ❒ 9. Install C10, a 100-220µF electrolytic capacitor. Electrolytic capacitors are marked by polarity and must be installed in the proper direction. You'll see that one side of the capacitor has a black band and is marked with a '-' sign, this is the negative side, the other side is the positive lead. Make sure you insert the positive lead into the '+' marked hole on the PC board.
- ❒ 10. Install C11, a 100-220µF electrolytic capacitor. Remember to observe correct polarity. C10 and C11 provide voltage stabilizing which directly improves the performance of the SA602 oscillator.
- ❒ 11. Install C2, 100pF ceramic disc capacitor (marked 100 or 101). This

capacitor is a first step in setting up the resonant frequency of the SA602's internal oscillator, using the resonant LC circuit to be created along with C1, C3 and L1.

- ❒ 12. Install C1, 100pF disc capacitor (marked 100 or 101K).
- ❒ 13. Install C3, .001µF disc capacitor (marked 102 or .001 or 1nF).
- ❒ 14. Install L2, shielded oscillator coil (marked K6883 or K6886).
- ❒ 15. Install C4, 100pFdisc capacitor (marked 100 or 101). C4 adds variable capacitance of the varactor tuning network to the oscillator circuit already formed by L2, C1, C2 and the SA602.
- ❒ 16. Install D1, the 1N4002 diode, making sure that the cathode or banded end is oriented towards the back of the PC board. This diode performs the function of a varactor diode. A varactor diode acts like a variable capacitor whose capacitance is controlled by the voltage across it. There is nothing fancy about the varactor diodes, so we are using a common rectifier diode as a varactor.
- ❒ 17. Install R5, 10k ohms (brown-black-orange)
- ❒ 18. Install R2, 10k potentiometer tuning control.
- ❒ 19. Install R3, 10k potentiometer volume control. This control varies the level of audio from pin 4 of the SA602 to the LM386 audio amplifier.
- ❒ 20. Using a scrap piece of wire, snipped from an installed component, install JMP-1. Jumpers are required sometimes in PC board layout to make a connection that has to cross over other PC-board traces.This particular jumper brings 9 volts from the power switch to the long circuit trace supplying voltage to the entire circuit. Notice how the jumper crosses over the other traces leading from the volume control.
- ❒ 21. Install S1, the power switch.
- ❒ 22. Install the 9-volt battery snap connector, making sure that the red (+) and black (-) leads are correctly installed.
- ❒ 23. Install C7, .01µF disc capacitor (marked 103 or .01 or 10nF).
- ❒ 24. Install C8, a small 4.7-10µF electrolytic capacitor. Observe correct polarity.
- ❒ 25. Install R6, 10K ohm resistor (brown-black-orange).
- ❒ 26. nstall U2, the LM386 audio amplifier IC chip. Just like the SA602, you must correctly position the notched or banded end.
- ❒ 27. Install C12, 100-220µF electrolytic capacitor; observe polarity. This capacitor couples the output of the LM-386 to the speaker jack.
- ❒ 28. Install C9, 4.7-10µF electrolytic capacitor; observe polarity.

❒ 29. Install speaker jack J2. This jack is a 2.5mm type and mates with any 2.5mm plug as found on virtually all mini earphones.

❒ 30. Install the 9-volt battery clamp. Use a scrap component lead to loop through the two holes in the clamp and through the PC board. Solder the leads firmly to the board and to the battery clamp. Do not use too much solder on the clamp as this will cause the battery to sit too high and not seat securely.

Congratulations! You have completed the assembly of your HR40 receiver kit. Now is a good time to sit back and admire your work and make a final check of all solder joints and component placement. It is always better to find errors now before you test the HR40, and it's easier on the ego, too!

INITIAL TESTING OF YOUR HR40:

You're now ready to power up and test your HR40, but before you begin take some time to sweep off your bench of any loose component leads or solder splashes. A clean work area not only makes testing less frustrating but also less prone to problems.

REQUIRED FOR INITIAL TESTING AND ALIGNMENT:

A known frequency standard in the 10MHz range such as:

- Crystal oscillator or,
- RF signal generator or,
- Grid Dip oscillator or,
- QRP transmitter such as a Ramsey QRP-40
- A Ramsey frequency counter (CT-90, etc) or,
- Any accurately calibrated receiver covering 40 meters
- At the least, personal familiarity with the 40 Meter Ham band

And the following:

- Coil alignment tool (can be homemade per directions) and
- 9-volt battery, antenna earphones or a small speaker.

Connect the following:

- ❒ Fresh, 9-volt battery.
- ❒ Earphone or speaker.
- ❒ Antenna or at least a random length of wire.
- ❒ Adjust the three controls to the middle of their ranges.
- ❒ Press the power switch "on". You should hear background noise immediately, at least a gentle hiss.
- ❒ See if the volume control does its job, vary it and notice how the volume changes.
- ❒ See if the RF gain control has some effect on what you hear.
- ❒ If everything seems ok so far, feel the tops of the two IC's with your finger. Neither should feel hot or warm
- ❒ Slowly rotate the tuning control. At this point you may or may not hear anything, since neither coil has been adjusted. If you do hear a few whistles as you tune, the SA602 oscillator is working just fine.
- ❒ These simple initial checks verify that your receiver is operating well enough to proceed to the next section, alignment.

Alignment:

Turn on whatever reference signal source you plan to use. This can be a regular transceiver keying a few milliwatts into a dummy load, a crystal oscillator or a signal generator. Or, you can look for a known signal that you have tuned in on another receiver.

If you are without any reference signal whatsoever but have a reasonable antenna , you can use your familiarity with the 40-meter band to make a rough alignment of the receiver.If Ham radio and 40 meters are new to you, here's a rough idea of what you can expect to hear on this busy band.

7.00 - 7.08 MHz - CW, most of it is fairly fast
7.08 - 7.15 MHz - Teletype (RTTY) and digital operation
7.10 - 7.20 MHz - SSB voice, many different languages
7.20 - 7.35 MHz - general SSB voice operation

NOTE: A miniature transformer alignment tool is used to turn the slugs in L1 and L2. If you do not have one, make one by gently sanding the tip of a wooden match stick, a kabob skewer or other piece of wood or plastic. While it seems that a small jeweler's screwdriver could be used, be aware that its metallic construction will make adjustment of L2 very erratic and could damage the powdered iron slug. Any kind of metal tip will affect the coils true value, so that the oscillator will run at one frequency with the metal instrument in the coil can, and a completely different frequency by itself.

- ❒ For now, set the tuning control to its mid-point. Use the insulated alignment tool to gently rotate the slug in the top of L2. If it starts to get tight , DO NOT FORCE IT! Instead gently rock it back and forth until it loosens up. You should find your 7MHz reference over a range of approximately 6 to 9MHz. The varactor tuning control can cover any 300KHz range chosen within the 6 to 9MHz limits.
- ❒ Adjust L1 for maximum received signal strength. Now you're ready to receive on-the-air signals! After you get used to its tuning and performance, you can adjust the tuning control, L1 and L2 to get the exact tuning range you want.

ALIGNMENT HINT FOR ALL DIRECT CONVERSION RECEIVERS:

You will clearly hear the oscillator of your kit - very close to its receiving frequency, if you tune around for it on ANY shortwave radio covering the same frequency range. Even if your shortwave set does not have a BFO (beat frequency oscillator) for CW-SSB, you'll still hear a powerful 'hiss or quieting' when your shortwave receiver is tuned near the frequency of the HR40. Your shortwave receiver is actually picking up the oscillator signal within the HR40!

USING YOUR RECEIVER:

In your first tests, you might feel that tuning in CW and SSB stations by turning the control shaft seems tricky. Don't despair! The addition of a simple knob to the final version of your kit will result in more comfortable tuning right away. Also, the larger the knob, the easier the tuning is. Even smoother control can be accomplished by a vernier dial, which will also provide calibration marks. Finally, if you intend to use this receiver only for monitoring or working a very specific frequency range, you can add a resistor in series with the tuning control to achieve the bandspread you want for your own application. For details, please see the upcoming section, Notes to Experienced QRP Builders.

We want you to enjoy this economical receiver, whether you use it for portable listening or as a base for easy experimentation. Isn't it amazing the performance that can be achieved with just two IC chips?

- **TUNING SSB SIGNALS**

As you know, the protocol for the 160 - 80 - 40 Meter Bands is lower sideband (LSB), with Upper Sideband (USB) used for 40 - 18 - 15 - 12 - 10 Meter SSB. To check or 'scan' a given band for SSB signals, tune your HR40 up from the low end for USB signals and down from the high end for LSB.

- **CW OPERATION**

A direct-conversion receiver lets you hear equal 'sidebands' on either side of the zero-beat 'null' of the exact frequency of the signal to which you are listening. Therefore, when adjusting the frequency of your companion Ramsey QRP transmitter, be certain that you have in fact tuned to the other station's lower sideband. The two stations will actually be several KHz apart. Because this receiver's oscillator is not shared with a transmitter, as in transceivers, there is no need for separate RIT (receiver incremental tuning).

- **ON THE AIR TRANS-RECEIVING**

Let's assume that you plan to use this receiver together with a Ramsey QRP transmitter, which provides an RF protected receiver antenna jack. While the receiver will be protected from RF damage from the transmitter, do not expect to monitor your own signal on this receiver while transmitting unless you are a QRP design expert and do not care about future factory service from Ramsey. Even with the circuit protection, the RF signal is just too much for the SA602. The transmitter signal overpowers the SA602, disrupting the internal oscillator. However, the receiver can handle the output of a crystal oscillator or VFO for frequency spotting purposes.

A better operating arrangement will consist of a T-R switch, either a manual switch or break-in delay relay circuit. This switching circuit can disconnect the SA602 audio output at the volume control, and switch in a pleasant oscillator pitch (keying sidetone) which is amplified to listening level by LM386. The Ramsey Electronics Universal timer kit No. UT-5 is easily adapted as a sidetone oscillator.

- **SPEAKER OPERATION**

A fifty cent, two inch diameter speaker, lying naked on your workbench will give you a fair test of the speaker output capability. Speaker quality and well-designed enclosures have their clear purposes! A reasonable speaker in a box delivers a pleasant listening volume. On the other hand, the LM386 indeed can deliver more audio output punch than is developed in our HR-series kits. For example, our FM receivers, using the same LM386 audio IC, deliver more volume. These receivers, however, take advantage of IF amplifiers, drift-compensation and crystal controlled oscillators built into mass production, sophisticated FM receiver ICs. A heavier drain on the HR40's battery by stronger audio will quickly result in chirpy signals and oscillator drift as well as the need for frequent battery replacement. Remember the SA602 circuits similar to Ramsey's generally call for sets of C or D cell batteries! For Experienced Builders more information regarding audio output is in the general notes.

The simple design of the audio stage of the Ramsey HR40 receiver assumes preference for headphone or small speaker operation, low battery drain and general economy.

- **MORE AUDIO POWER - ANOTHER WAY**

If you want to use your HR40 for casual band monitoring while you are busy across the room, in the shop, or to share with a class or club, and want LOTS more volume, try building up our very inexpensive Ramsey BN-9, 2 watt general purpose amplifier kit. Supply DC voltage to such an amplifier separately, using D-cells, a lantern or auto battery, or a well filtered power supply.

- **ADDING AN LED POWER ON INDICATOR**

For many people, a pilot lamp to indicate "power on" is more than a nice touch. They expect it and depend on it , reminding us that "real radios glow in the dark!"

Adding a simple LED power-on indicator to your Ramsey HR40 is easy. All you need is the LED itself and a small 1K or 2.2K resistor. Study the PC traces between the positive battery supply wire and the on-off switch. The unused connectors on top of your switch are an ideal point to get the + DC voltage needed for the anode (longer lead) of the LED. Plan where and how

you wish to install the LED in your enclosure. Locating the LED immediately above the on-off switch is ideal. The simplest way to make a neat installation is to drill a hole just sightly smaller than the diameter of the LED. Then, enlarge the hole a little bit at a time, just enough to let the LED be pressed in and held firmly. The resistor may be connected to either the anode or cathode side of the LED, but the anode must be connect to the + DC with the cathode connected to the nearest common ground.

If you are wondering why we did not include these pennies worth of parts with your kit , you can believe any of the following reasons: (1)We wanted to stretch your battery budget and the current draw on the LED is about 6mA. How long will your battery last if you leave your receiver on for a few days, just like we leave our computers and ham gear on all the time? (2) We thought you'd have more fun planning and installing your own lamp that glows in the dark!

TROUBLESHOOTING TIPS:

PROBLEM: ALL signals are chirpy and unstable.
SOLUTION: Sorry to have to say it , but this condition is only caused by a weak battery! Use a fresh alkaline cell. Any strong signal forces the audio circuit to rob voltage from the oscillator, which causes the instability.

PROBLEM: Occasionally good but erratic operation.
SOLUTION: Check very carefully for a poor solder connection.

PROBLEM: Signals have an unpleasant hissing pitch.

SOLUTION: Try a different set of headphones, different speaker or external audio amplifier. Some cheap headphones designed for casual music listening have an undesirable filtering effect on CW signals.

PROBLEM: Oscillator inoperative or wrong frequency.

SOLUTION: In addition to checking solder joints, be sure that L1 is oriented correctly and that C1, C2, C3 and C4 are installed in correct positions.

PROBLEM: Loud AC hum or buzz.

SOLUTION: If you are using the receiver with a battery or simply for listening (i.e.: not connected to a transmitter or a AC power adapter), these are likely causes of the AC hum:

- No ground connection.
- Receiver located too close to an AC device such as an older electric clock, AC-powered radio, etc.
- Antenna very close to a power cord or house wiring. If your receiver is being used with a transmitter, the transmitter power supply may be the source of the unwanted AC hum. If you are using a 9-volt AC power adapter, the adapter design may not be of sufficient quality for this application. Try a bypass capacitor, or a different adapter or a well-designed and filtered DC power supply.

A careful check of all construction WILL solve your problem. Over 95% of the kits returned for repair have nothing more than a simple assembly or construction error!

GENERAL NOTES FOR EXPERIENCED QRP BUILDERS:

We at Ramsey Electronics deliberately designed the HR-series of DC receivers to be easily available, affordable and buildable by any person willing to follow the assembly directions. To achieve this goal, the current models, with direct coupling of the SA602 to the LM386 operating with a gain figure of 50, use an amazing minimum of parts. If you know what you are doing with DC receiver design, we encourage you to use our HR-series for reliable building blocks for achieving maximum performance for you own application. If a good idea does not work as expected, you can easily restore your Ramsey receiver to its original circuit configuration.

Our job has been to keep in stock for immediate delivery a good basic design, a quality PC board with plenty of work room, useful front panel controls, correct and adjustable inductors, workable varactor tuning and the popular SA602. We know these receivers WORK, as specified, and that the ONLY reason any HR-receiver will not work after the 1-2 hours needed for assembly is if we packed the wrong parts or you put them in wrong. Once you are sure the receiver performs as specified, there is a lot you can do to coax maximum performance from the basic circuit.

For instance, if you choose a DC power source other than the 9-volt battery, the space allowed for the battery offers plenty of room for a top mounted perfboard or PC-board for preamp stages and or any sort of passive or active audio filter that suits your needs. Keep your work neat with short leads so as not to introduce broadcast station overload.

ALTERNATE POWER SOURCES:

Most of the HR40 circuitry can be operated from 6 to 14 volts without damage or significant modification. However, it is quite important that you carefully hook up with the correct polarity; reverse polarity or excessive voltages WILL damage your kit.

BANDSPREAD AND TUNING RANGE:

The easiest way to enjoy finer tuning , if you plan to use your receiver only for checking your favorite segment of the band, is to adjust the oscillator coil so that your desired segment falls within the second half of the rotation range of the tuning control. The first half of the rotation range covers about 70% of the actual tuning in KHz, while the other 30% is spread over the other half of the rotation range. If your interest is in monitoring SSB, the normal alignment will work fine. For optimum CW only listening, set the lower band edge with the tuning control in the 12:00 position of its range.

In planning any ‘bandspread’ improvement, it is useful to understand exactly how varactor tuning works. The control level varies the amount of DC voltage applied to the diode. The highest produces the lowest capacitance, while the lowest voltage yields the highest capacitance. The spread is typically about 30 to 40pF. from minimum to maximum.The goal in achieving bandspread or ‘finetuning’ is to achieve a smaller variation in capacitance with the comfortable tuning of a knob.

Any resistor in a range from 500 ohms to 3000 ohms, connected in series with the ground lead of R2, will set a limiting effect on varactor capacitance range and therefore create a “bandspread “ effect. The higher the resistance value, the shorter the available tuning range.

If you wish to reduce the tuning range of R2 down to 40 or 30KHz or even less for a favorite band segment or calling frequency, reducing the value of C4 will decrease the capacitance effect of the varactor diode, D1. Values from 2 to 5pF may give you exactly the tuning range you are looking for.

If you are using your own enclosure and have room for a separate fine tuning control, one useful choice is a 250 ohm speaker attenuation rheostat (Radio Shack model no. 271-265) wired in series with either outside ‘leg’ of the main tuning control. Such a control can make fine adjustments to a CW signal so the tone is pleasant and smooth sounding.

If you want the opposite of bandspread (that is as MUCH frequency range as possible over full rotation of the tuning knob) increase the value of C4. This will cause the varactor diode to have greater effect on the tuning. Try values of 33pF up to 100pF.

FREQUENCY STABILITY:

A kilohertz of drift is not a big deal in FM circuits or a shortwave broadcast configuration, but ANY frequency instability is annoying when trying to receive CW or SSB. The varactor - controlled Local Oscillator is indeed a VFO, and therefore needs all the consideration given to any VFO circuit. Even though this tunable oscillator design takes good advantage of the SA602’s capabilities and offers nice tuning range from a simple varactor circuit, we do not represent it as suitable for transmitter frequency control or for demanding receiver applications. In any ham VFO design, ANY unshielded or uncompensated oscillator components are susceptible to the influences of temperature change and of nearby moving objects. The use of a suitable enclosure and secure mounting of the PC board within that enclosure will maximize the stability of the oscillator. One to two KHz of slow drift may be expected as components warm to operating temperature; after that the oscillator is reasonably stable

OTHER METHODS OF DIAL CALIBRATION:

A easy way of making your own dial is to paste a small rectangle of paper behind the tuning dial knob. Then as you tune in different frequencies, pencil in on the paper the received frequency. Or a simple logging scale may be affixed behind the tuning knob on the front panel. A logging scale is simply a set of numbers for adjusting a control. For example, 4 might represent 7.1MHz and 5.5 being 7.12MHz, and so forth.

DIRECT FREQUENCY READOUT:

A novel advantage of the simple direct conversion receiver is that a general purpose frequency counter may be used to give a direct readout of the oscillator frequency. While you could experiment with an RF pickup loop or tuned circuit and counter preamplifier to boost the oscillator's tiny output to a level suitable for the counter, the most reliable method is to wire a high-impedance counter probe line directly to pin 7 of the SA602, terminated to a rear panel frequency counter connection of your choice. This will consist of a short piece of mini-coax to a 1 megohm resistor bridged by a 27 to 33pF capacitor as shown below:

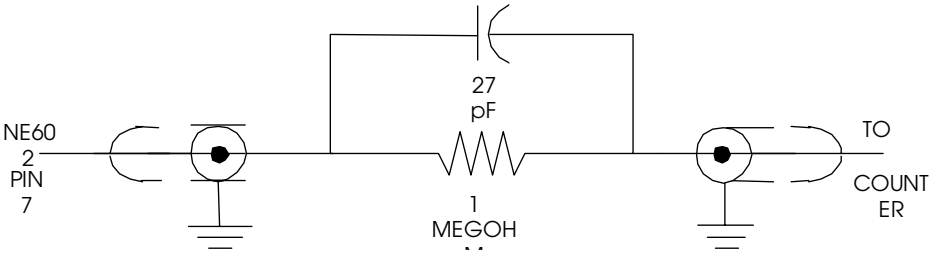
With the RF gain turned all the way up , it may be possible to hear the counter's busy humming action in the background, but not to a serious degree. It drops out with a slight reduction of the RF gain. If you decided to add such a counter connection to your receiver, remember that the coax as well as the coupling capacitor become part of the oscillator circuit. Make the coaxial cable connecting the counter to the receiver as short as possible. You will experience a frequency change of several KHz when connecting or disconnecting the counter. Also, this additional capacitance in the oscillator circuit reduces the tuning range to approximately 100 KHz, thus offering another way of getting bandspread for your favorite frequencies. Finally, it may be necessary to operate the counter on battery power only; connection of an AC adapter might introduce considerable hum into the receiver.

THE LM386 AUDIO OUTPUT:

As already mentioned the LM386 is certainly capable of far more audio power output than is given in this basic receiver circuit. It can only boost what it gets directly from the SA602. There is certainly space on the HR40 circuit board to install an audio preamplifier (i.e. 2N3904, or minimum-gain LM386) in the circuit trace between C8, the audiocoupling capacitor from pin 4 of the SA602 to the volume control. The following is an audio preamplifier idea submitted by one of our customers. Ramsey Electronics in no way warrants that this modification will achieve any particular ideal signal-to-noise ratio or audio

frequency response, but is does significantly boost the output of the SA602 reaching the LM386 audio amplifier IC. Instead of the traditional transistor audio preamp circuit, an additional LM386 is used in its minimum gain configuration (gain of 40), plus one electrolytic capacitor (1 to 10 uF) to achieve minimum parts and PC-board drilling. This use of two LM386 ICs amplifies the audio signal of the SA602 by a factor of 1000.

This modification requires cutting the circuit trace leading from C8 to the



volume control, R3.

Additional LM386 used as AF preamplifier between U1 and U2:

- ❒ Pins 1,7,8: not used
- ❒ Pins 2,4: to ground
- ❒ Pin 3 to '-' side of c*(2.2 pF)
- ❒ Pin 5 to '+' side of new 1 to 10 uF capacitor
- ❒ Pin 6 to '+' DC supply board trace

The '-' side of the new capacitor is connected to the circuit trace leading to the volume control. Mount this capacitor as close to the body of the new LM386 as possible. Keep all leads as short as possible. This modification results in very good speaker volume but will also require closer attention to battery quality and condition or else the audio circuits will cause oscillator instability. Two alkaline cells in parallel or a 12 volt supply are recommended. If the gain is too much, use a resistor to reduce the voltage supplied to pin 6 of preamp LM386

Finally, we remind you again that modification of any PC board puts you on your own, voiding your factory warranty, making your unit ineligible for factory repair. Make sure the receiver is working properly and that you understand how to use and repair it BEFORE making any changes in the original design. Enjoy it!

CONSTRUCTION NOTES:

The Ramsey Kit Warranty

Please read carefully BEFORE calling or writing in about your kit. Most problems can be solved without contacting the factory.

Notice that this is not a "fine print" warranty. We want you to understand your rights and ours too! All Ramsey kits will work if assembled properly. The very fact that your kit includes this new manual is your assurance that a team of knowledgeable people have field-tested several "copies" of this kit straight from the Ramsey Inventory. If you need help, please read through your manual carefully. All information required to properly build and test your kit is contained within the pages!

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

2. MISSING PARTS: Before assuming a part value is incorrect, check the parts listing carefully to see if it is a critical value such as a specific coil or IC, or whether a RANGE of values is suitable (such as "100 to 500 µF"). Often times, common sense will solve a mysterious missing part problem. If you're missing five 10K ohm resistors and received five extra 1K resistors, you can pretty much be assured that the '1K ohm' resistors are actually the 'missing' 10 K parts ("Hum-m-m, I guess the 'red' band really does look orange!") Ramsey Electronics project kits are packed with pride in the USA. If you believe we packed an incorrect part or omitted a part clearly indicated in your assembly manual as supplied with the basic kit by Ramsey, please write or call us with information on the part you need and proof of kit purchase.

3. FACTORY REPAIR OF ASSEMBLED KITS:

To qualify for Ramsey Electronics factory repair, kits MUST:

1. NOT be assembled with acid core solder or flux.
2. NOT be modified in any manner.
3. BE returned in fully-assembled form, not partially assembled.
4. BE accompanied by the proper repair fee. No repair will be undertaken until we have received the MINIMUM repair fee (1/2 hour labor) of $18.00, or authorization to charge it to your credit card account.
5. INCLUDE a description of the problem and legible return address. DO NOT send a separate letter; include all correspondence with the unit. Please do not include your own hardware such as non-Ramsey cabinets, knobs, cables, external battery packs and the like. Ramsey Electronics, Inc., reserves the right to refuse repair on ANY item in which we find excessive problems or damage due to construction methods. To assist customers in such situations, Ramsey Electronics, Inc., reserves the right to solve their needs on a case-by-case basis.

The repair is $36.00 per hour, regardless of the cost of the kit. Please understand that our technicians are not volunteers and that set-up, testing, diagnosis, repair and repacking and paperwork can take nearly an hour of paid employee time on even a simple kit. Of course, if we find that a part was defective in manufacture, there will be no charge to repair your kit (But please realize that our technicians know the difference between a defective part and parts burned out or damaged through improper use or assembly).

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

HR40 AMATEUR RECEIVER KIT
Quick Reference Page Guide

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Parts layout 10
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REQUIRED TOOLS

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

<OR> Technician's Tool Kit TK405

ADDITIONAL SUGGESTED ITEMS

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

Price: $5.00
Ramsey Publication No. MHR40
Assembly and Instruction manual for:

RAMSEY MODEL NO. HR40
AMATEUR RECEIVER KIT

TOTAL SOLDER POINTS
84

ESTIMATED ASSEMBLY TIME
Beginner ..... 3.0 hrs
Intermediate..... 2.0 hrs
Advanced..... 1.0 hr

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