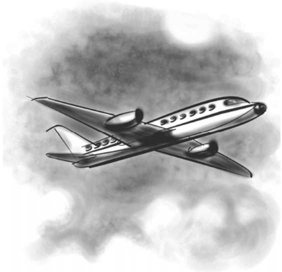
AIRCRAFT RECEIVER KIT



Ramsey Electronics Model No. AR2WT

A new and improved version of our popular Aircraft Receiver kit, this new model features an LCD display, scan function, and increased sensitivity, all in a rugged metal enclosure. Rivals professional units costing much more!

- **Tunes the entire 118 - 136 MHz Air band**
- **Operates on 12 to 15 VDC**
- **Scan function “finds” the signals for you; no more laborious tuning to find a transmission**
- **Memory locations make it easy to refind your local favorites**
- **Listen to control towers, centers, and planes en-route**
- **Very sensitive; picks up planes 100 miles away!**
- **Great project for all pilots and flight students**
- **Clear, concise step-by-step instructions carefully guide you to a finished kit that not only works - but you’ll learn too!**

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RAMSEY TRANSMITTER KITS
- **FM10A, FM25B, FM30, FM Stereo Transmitters**
- **FM100B, FM35 Professional FM Stereo Transmitters**
- **AM1, AM25 AM Broadcast Band Transmitters**

RAMSEY RECEIVER KITS
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- **AR1 Aircraft Band Receiver**
- **SR2 Shortwave Receiver**
- **AA7 Active Antenna**
- **SC1 Shortwave Converter**

RAMSEY HOBBY KITS
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- **SS70C Speech Scrambler/Descrambler**
- **TT1 Telephone Recorder**
- **SP1 Speakerphone**
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- **PH14 Peak hold Meter**
- **LC1 Inductance-Capacitance Meter**

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AR2
Ramsey Electronics publication No. AR2 Rev. 1.3a
July 2005

Ramsey Publication No. AR2
Manual Price Only $5.00

INSTRUCTION MANUAL FOR

AIRCRAFT RECEIVER

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INTRODUCTION TO THE AR2 AVIATION RECEIVER KIT

The Ramsey AR2 Aviation Receiver is a new design of our original Ramsey AR1 Aircraft Receiver. The AR1 has been built and loved for years by hobbyists with an interest in both aviation and electronics. The AR2 design takes the best of the AR1 and adds scanning functions, and a slick metal case for superior noise reduction. It is characterized by exceptional sensitivity, image rejection, signal-to-noise ratio and stability. It is designed for casual "listening in"- on both ground and air communication, for both commercial airlines and general aviation. The AR2 has been built by folks of all ages and skill levels, and in less time than it takes to fly solo!

118-136 MHz, WHAT YOU CAN EXPECT TO HEAR

A basic fact about the VHF Aviation Band which even licensed pilots can overlook or forget is that communications are in the AM mode, not FM, as in the case of the FM broadcast band immediately below it, and the VHF public service and ham bands immediately above it.

No matter where you live you will be able to receive at least the airborne side of many air traffic communications. You'll hear any aircraft you can see, PLUS planes up to 100 miles away and more, since VHF signals travel "line of sight." An airliner at 35,000 feet altitude is still line of sight to your antenna. Similarly, whatever ground stations you may hear are also determined by this "line of sight" characteristic of VHF communication. If there are no major obstacles between your antenna and an airport (tall buildings, hills, etc.) you'll be able to hear both sides of many kinds of aviation communication. Be prepared for them to be fast and to the point, and for the same airplane to move to several different frequencies in the span of a few minutes! Here's a brief listing of the most common types of services in the NAS (National Airspace System) with which pilots communicate:

Clearance Delivery
At most metropolitan airports a pilot communicates with the FAA on a frequency called "Clearance Delivery" to obtain approval or clearance of the intended flight plan. This communication is done before contacting ground control for taxi instructions.

Ground Control
From the control tower, ground movements on ramps and taxiways are handled on the “Ground Control” frequency.

Control Tower
Runway and in-flight maneuvers near the airport, usually within three miles (takeoffs, local traffic patterns, final approaches and landings) are on the “Control Tower” frequency.

ATIS – Automated Terminal Information System
ATIS, is a repeated broadcast about basic weather information, runways in use, and any special information such as closed taxiways or runways.

ASOS/AWOS – Automated Surface Observing System/Automated Weather Observing System
This system is similar to ATIS but usually located at un-towered airports.

Approach Control & Departure Control
These air traffic radar controllers coordinate all flight operations in the vicinity of busy metropolitan airport areas.

ARTCC – Air Route Traffic Control Center
When you hear a pilot talking with "Jacksonville Center" or "Indianapolis Center", you know the aircraft is really enroute on a flight rather than just leaving or just approaching a destination. A pilot will be in touch with several different "Regional Centers" during a cross-country flight.

CTAF – Common Traffic Advisory Frequency
Airports without control towers are controlled by the pilots themselves and they rely on the local CTAF frequency dedicated only to advisory communications between pilots and ground personnel such as fuel service operators. The people on the ground can advise the pilot on the status of incoming or outgoing aircraft, but the pilot remains responsible for landing and takeoff decisions. Typical CTAF frequencies are 122.7, 122.8 and 123.0 MHz. Unicom frequencies are used at manned towered airports for day to day businesses at 122.75, 122.85, and 122.95 MHz.

FSS - FAA Flight Service Stations
The FAA's network of Flight Service Stations keeps track of flight plans and provides weather briefings and other services to pilots. Some advisory radio communication takes place between pilots and a regional "FSS". If there is an FSS in your local area, but no airport control towers, the FSS radio frequency will stay interesting. Typical frequencies are 122.1, 122.6, and 123.6 MHz. Pilots always address the FSS by calling the FSS name followed by “Radio”.

ELT – Emergency Locator Transmitters
Emergency and guard channels are used by airplanes in flight operations during an emergency or talking on official business and can be heard on 121.5MHz.

ACARS - Aircraft Communication Addressing and Reporting System
ACARS is a digital VHF radio data link which allows airline flight operations departments to communicate with the various aircraft in their fleet.   ACARS is used by many civilian and business aircraft and is similar to “email for airplanes". Each aircraft has its own unique address in the system. Traffic is

routed via computers to the proper company, relieving some of the necessity for routine voice communication. With ACARS, routine items such as departure reports, arrival reports, passenger loads, fuel data, engine performance data, and more can be retrieved from the aircraft at automatic intervals. The transmission will sound like a short data burst to the ABM1 user.

THOSE FAST-TALKING PILOTS AND CONTROLLERS!

Aviation communication is brief but it is clear and full of meaning. Usually, pilots repeat back exactly what they hear from a controller so that both know that the message or instructions were correctly interpreted. If you are listening in it is hard to track everything said from a cockpit, particularly in big city areas. Just to taxi, take off, and fly a few miles, a pilot may talk with 6 or 8 different air traffic control operations, all on different frequencies, all within a few minutes! Here are the meanings of a few typical communications:

"Miami Center, Delta 545 Heavy out of three-zero for two-five."

Delta Flight 545 acknowledges Miami Center's clearance to descend from 30,000 feet to 25,000 feet altitude. The word "heavy" means that the plane is a jumbo jet such as 747, DC-10, etc.

"Seneca 432 Lima cleared to outer marker. Contact Tower 118.7."

The local Approach Control is saying that the Piper Seneca with the N-number (tail number) ending in "432L" is cleared to continue flying an instrument approach to the outer marker (a precision radio beacon located near the airport) and should immediately call the airport radio control tower at 118.7 Mhz. This message also implies that the approach controller does not expect to talk again with that aircraft.

"Cessna 723, squawk 6750, climb and maintain five thousand."

A controller is telling the Cessna pilot to set the airplane's radar transponder to code 6750, climb to and fly level at an altitude of 5000 feet.

"United 330, traffic at 9 o'clock, 4 miles, altitude unknown."

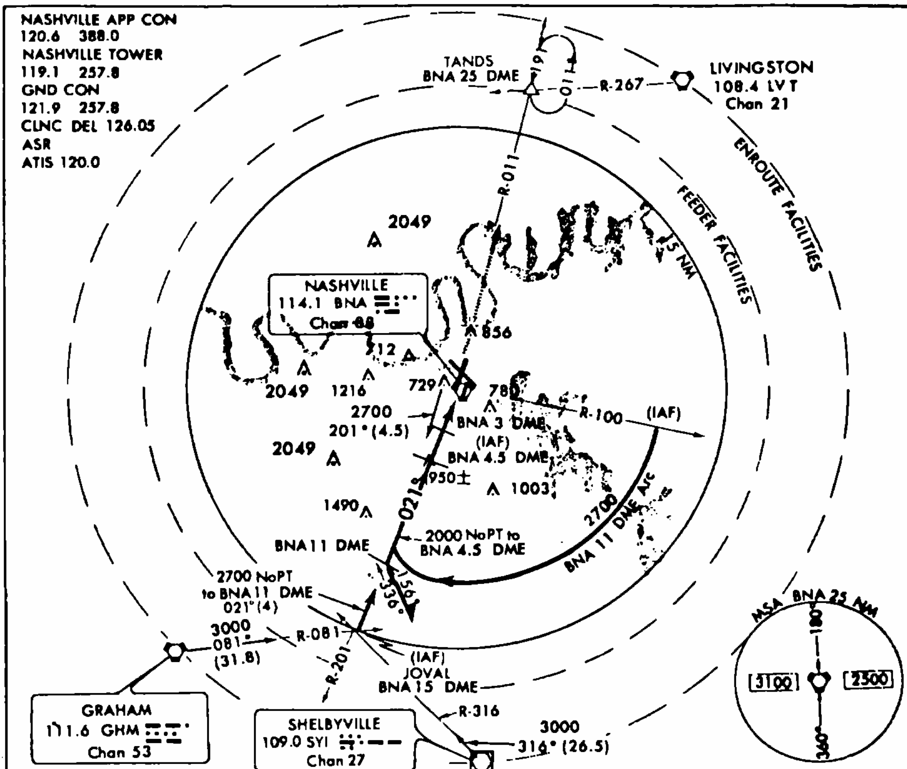
The controller alerts United Airlines flight #330 of radar contact with some other aircraft off to the pilot's left at a 9 o'clock position. Since the unknown plane's altitude is also unknown, both controller and pilot realize that it is a smaller private plane not equipped with altitude-reporting equipment.

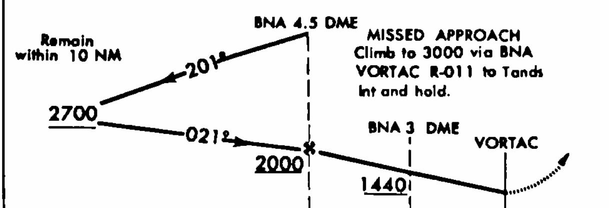
ELECTRONICS & FLYING: DOING IT "BY THE NUMBERS"

A peek at the sample FAA "instrument approach" chart for medium-large airports shows that pilots deal with many vitally important numbers and must do so quickly. Among the numbers on that chart, can you find the air-ground communications frequencies which can be heard on the ABM1 receiver? Can you find frequencies for uses other than communications?

VOR/DME RWY 2L

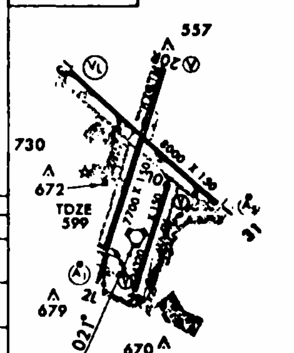
NASHVILLE METROPOLITAN (BNA)
NASHVILLE, TENNESSEE





MISSED APPROACH
Climb to 3000 via BNA VORTAC R-011 to Tands Int and hold.

ELEV 599 | TDZ/CL Rwy 2L



REIL Rwy 20R
MIRL Rwy 2R-20L
HIRL Rwys 2L-20R and 13-31
726

CATEGORY	A	B	C	D
S-2L	980/24 381 (400-½)			980/50 381 (400-1)
CIRCLING	1060-1 461 (500-1)		1080-1½ 481 (500-1½)	1160-2 561 (600-2)

CAUTION: Brightly lighted building west of ALS Rwy 2L.
With inoperative ALS, Cat. D visibility becomes 6000 RVR.

Knots	60	90	120	150	180
Min:Sec					

CIRCUIT DESCRIPTION

Radio Basics:

We'll take the circuit section by section; the letters show which part of the block diagram we're explaining in each section.

The AR2 is a simple super-heterodyne receiver. A heterodyne receiver is a receiver that first converts the desired received frequency into an IF frequency, or Intermediate Frequency. Many radios are designed this way due to a variety of reasons, but primarily because it is easy to perform filtering and amplification on the IF signal rather than the RF signal because the IF is a single frequency or small band of frequencies, whereas RF is quite a bit wider and usually much higher in frequency than IF.

To create an IF frequency we use a mixer (**D**) to down-convert the band of interest to the single IF frequency. A mixer is a non-linear device, meaning it will distort the incoming signal with an applied signal. In the case of a mixer used on a radio this means you will have two different frequencies on the inputs, which results in four signals on the output. The received frequency is connected to one input and the local oscillator or LO is supplied to the other. On the output you will have these two important frequencies as well as the sum and difference between the two frequencies.

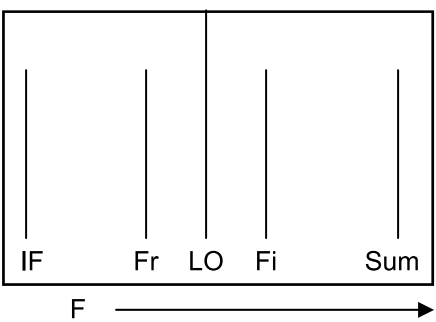


Figure 1

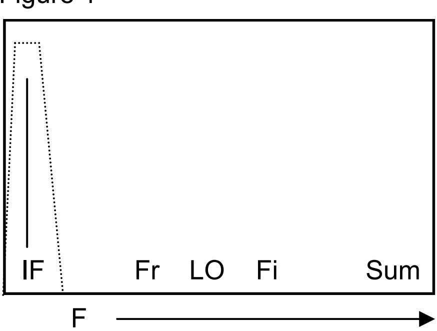


Figure 2

For example the aircraft band goes from 118MHz to 139MHz, and we plan to use an IF frequency of 10.7MHz, we need to have an LO of either 10.7MHz above the frequency we wish to receive, or 10.7MHz below. It is a matter of preference in which mixing byproduct you wish to work with, but in the case of the AR2 we use an LO of 10.7MHz above the frequency we wish to receive. This means that the LO needs to tune from 128.7MHz to 149.7MHz. This is called high-side mixing since the LO is above the frequency of interest. The LO is generated using a phase locked loop and voltage controlled oscillator on the AR2 (**J, D**).

Let's say for example that we wish to listen to the control tower at ROC (Rochester International Airport) at 118.300MHz. The LO frequency would

have to be set at 118.300 MHz + 10.700 MHz or 129.000MHz. It would then be sent to the mixer and on the output there would be 129.000MHz (LO), 118.3MHz(Fr), 247.3MHz(Sum) and 10.700MHz (IF). (See Figure 1)
After the mixer we use a narrow-band filter (E) to reject everything but the 10.7MHz IF signal output from the mixer. This works well because 10.7MHz is far from the next highest frequency, 118.3MHz, so it's easy to reject everything but the signal of interest. However, there is another signal you can receive that is 10.7MHz *above* the LO frequency. This is called the image frequency, and can be a real hassle in radio designs. In this case we could receive not only 118.3MHz but also 139.7MHz (2x IF + Fr). In this case this "image" is only 700kHz outside the band of interest and is almost impossible to filter out.

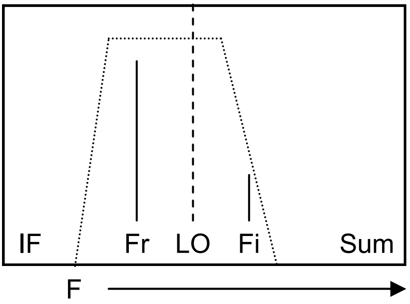


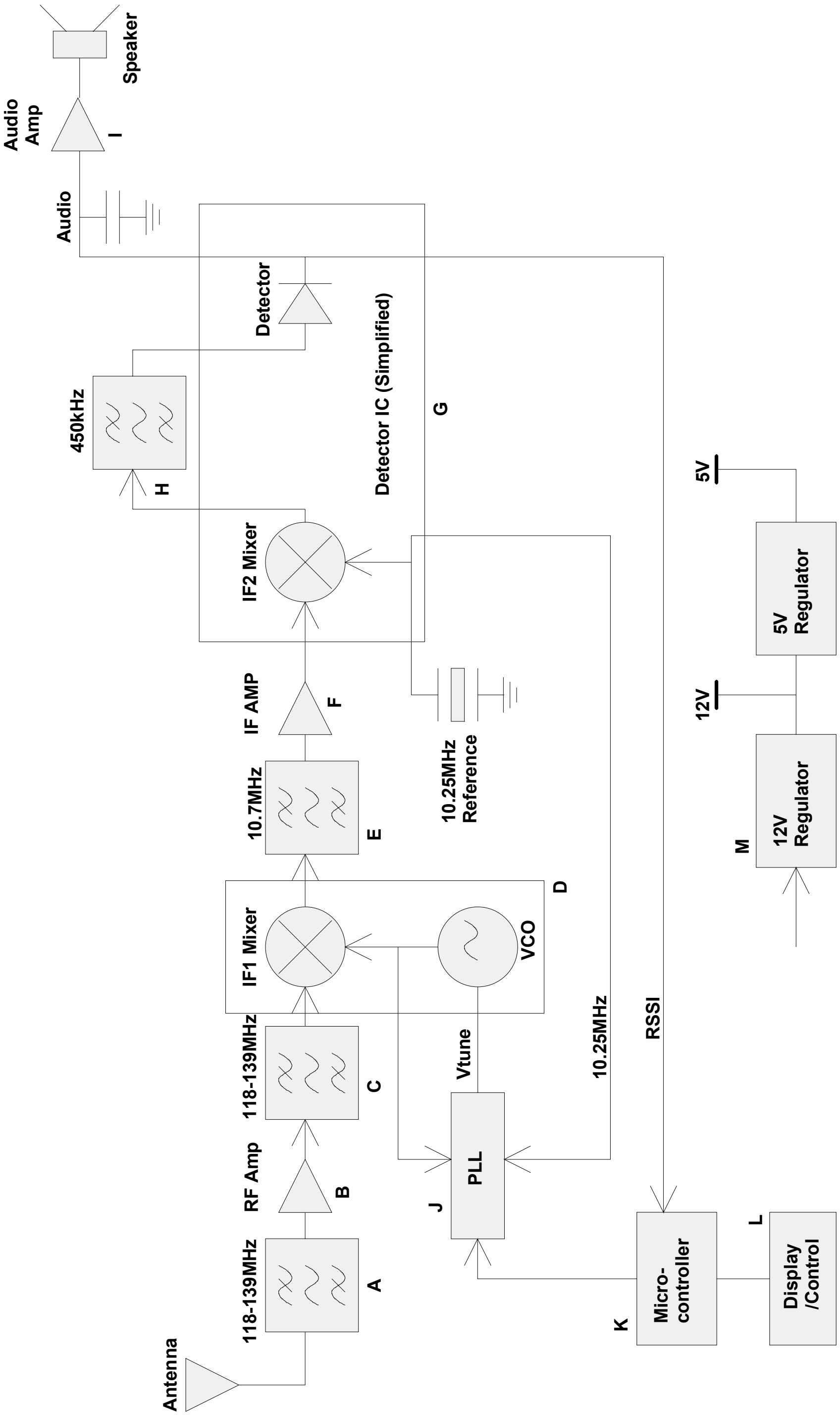
Figure 3

The AR2 reduces the reception of image frequencies by using good band-pass filters on the input to reject the image frequencies before they make it to the mixer (**A, C**). Figure 3 to the left shows what the RF input to the mixer looks like. Notice the Fi is greatly reduced by the input band pass filter, but not completely eliminated. The band pass filter certainly helps and gets rid of all but the strongest image signals outside the band.

Now that we have our filtered 10.7MHz IF at the output of the IF filter we can do some simple amplification on it (**F**), then send it to be demodulated into audio.

The IF signal is then sent to the AM detector part (**G**), where it is mixed down to yet another IF frequency of 450kHz by combining 10.7MHz with 10.25MHz. 450kHz is used due to the large array of components available at 450kHz, and it is also the frequency at which our particular AM demodulator works best. The signal is then amplified greatly to a consistent level using "slow" AGC within the detector part. The detector is able to receive quality AM signals in a 90dB range, since the AGC can amplify the signal up 90dB. The AGC is important in that all received signals within its range will be of the same audio amplitude. Otherwise weak signals would be very quiet, and nearby ones would be very loud. The reason it is "slow" is to allow changes in level due to audio to be left alone, but longer-term signal level changes due to distant signals and close signals to be compensated for.

The 450kHz IF, now that it is a consistent level, is demodulated using a full-wave rectifier and filter to remove the 450kHz, and leave the AM level behind as shown.


Antenna
118-139MHz
A
RF Amp
B
118-139MHz
C
IF1 Mixer
VCO
D
10.7MHz
E
IF AMP
F
IF2 Mixer
Detector IC (Simplified)
G
H
450kHz
Detector
Audio
Audio
Amp
I
Speaker
10.25MHz
Reference
10.25MHz
Vtune
PLL
J
RSSI
Micro-
controller
K
Display
/Control
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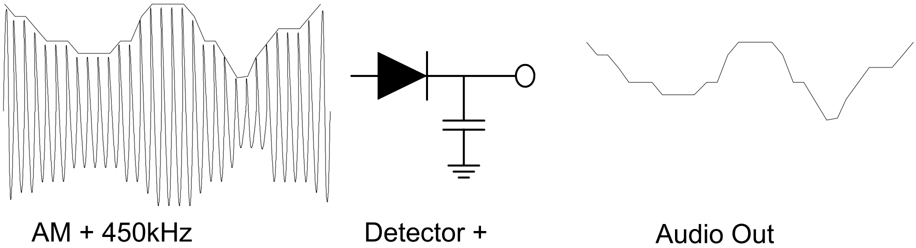
12V
Regulator
M
5V
Regulator
12V
5V



Since the AR2 is a relatively complex (and educational!) product, it's easiest to show you how things work by using a block diagram and explaining the different sections. This is a simplified block diagram, but is suitable for our needs.

Block A. RF band pass pre-filter. This is one of the two filters that helps reject image frequencies. Note the PCB layout has coils built right in! This makes for very precise, repeatable coils, and since the inductance for this design needed to be very small, this was a lot easier than installing a 1 ½ turn coil.

Block B. RF amplifier. This amplifier makes up for the "insertion loss" of the two filters, and increases the radio's sensitivity to weak signals. Insertion loss is defined as how much desired signal is lost by a filter or device.

Block C. RF band pass secondary filter. This section further reduces the possibility of image frequencies being received.

Block D. IF Mixer/VCO. This section consists of an NE602 mixer/oscillator that can be tuned using what is called a varactor diode in the oscillator section. A varactor diode is a reverse-biased diode that changes capacitance according to the reverse voltage. The higher the voltage, the wider the insulation (depletion layer) and the smaller the capacitance. Thus as the voltage goes up across the diode, so does the frequency! The tuned inductor sets the center frequency of our tunable band. We are limited to a little more than 21MHz, but we are never sure where this range is due to part variances. The coil allows us to get the 21MHz range centered in our band of interest so that the frequency will always remain locked throughout the band.

Block E. 10.7MHz IF filter. This is a special ceramic 10.7MHz filter for narrow-band AM. This helps in rejecting adjacent channels which are only 25kHz away. The filter is 13kHz wide, meaning 6.5kHz to either side.

Block F. This is a simple, single transistor IF amplifier. It has quite a lot of gain to make up for the insertion loss of the mixer/VCO as well as the 10.7MHz IF filter. This is the advantage of using a low frequency IF since a simple transistor amplifier works well here.

Block G. This is the main detector, AGC, 2nd LO, reference oscillator, and filtering all wrapped into one part.

Block H. 2nd IF filtering. This section is for further attenuating adjacent signals. The goal is to reduce signals 25kHz away more than 90dB, or the range of the AGC of the detector component. Two cascaded 450kHz filters are used here on top of the 10.7MHz ceramic filter.

Block I. After the AM has been detected the small level of audio signal is amplified enough to drive a speaker to respectable volumes

Block J. The Phase Locked Loop works in conjunction with the VCO (NE602 and varactor diode) and the reference 10.25MHz oscillator. The PLL part (U2, MC145170P2) has two dividers and some option registers for different designs that are usually set only once. One of the two dividers divides down the LO frequency from the VCO to make the channel step size 25kHz (N divider), and the other divides down the reference oscillator to the specific channel step size of 25kHz (C divider). The 25kHz is the reference comparator frequency, and the output of the PLL tries to make the VCO tune so that the output of it s divider is also “Locked” to 25kHz. A correction pulse is generated for each phase of the reference, and that is where phase locked loop comes from!

For example the PLL is programmed by the microcontroller to have a C value of 410. This means the reference clock of 10.25MHz is divided by 410 to give a divider output of 25kHz. This value remains constant throughout the AR2 circuit. To receive 118.3MHz we have to set the N value of the divider to give us 25kHz from the divided down RF of the LO frequency. Take (118.3MHz + 10.7MHz)/25kHz = N or 5160. Now the dividers are set up to request this LO frequency, however the VCO has not been tuned there yet. If there is any error between the “C” output and the “N” divider output, which there should be after switching the N divider, an internal comparator looks at the two 25kHz signals together then provides error correction pulses to tune the VCO to correct the difference.

For example the VCO frequency is too low, which results in 24.999kHz output at the N divider rather than 25kHz at the C divider. The PLL comparator output will then provide some high-going pulses to the PLL filter (U5:A and surrounding parts) to bring the tuning voltage up so the 25kHz divider outputs begin to come closer. Once the two frequencies match, small error pulses “tap” the VCO to keep it “phase locked” to the divided reference clock and make up for any environmental changes such as temperature and vibration.

The PLL filter removes the comparator error correcting pulses of 25kHz by low-pass filtering them. These tuning filters are also called integrators since they have no DC feedback. What results is a steady tuning voltage that allows the VCO to change smoothly from one channel to the next without 25kHz signals being “imposed” on the VCO. It also provides some amplification to give the VCO 0-12V of tuning from a 5V PLL part.

Block K. The microcontroller is the “brains” of the entire project. This device programs the PLL to get the frequencies desired, handles the jog dial by interpreting it’s pulses, and then writes the data to the displays. Quite a bit of coding is required to handle the scanning functions and the user interface, so don’t underestimate what goes on inside this little device!

Block L. This is the display and the user control devices.

Block M. Power supply section.

ANTENNA CONSIDERATIONS

An antenna for your AR1C can be as simple as a 21" piece of wire or a fancy roof-mounted aviation antenna. Most folks near an airport will get plenty of in-the-air action from the wire, but if you're more than a few miles away, a decent roof-mount job is the way to go. A low cost TV antenna works well, even better if rotated 90 degrees (remember aircraft antennas are vertically polarized). If you really want to learn and experiment, check out any book on antennas from your local library or do a search on the internet; there’s a wealth of information out there.

MODES OF OPERATION:

The AR2 uses an advanced way to access the many useful features built in to the unit. What looks like a volume control at first glance is actually a jog dial. No, it doesn't go for a jog at the end of a long work day, instead it allows you to enter values digitally in a convenient way.

There are a few modes of entry of using the jog dial:

a. Turn clockwise and counter clockwise
b. Press the knob and turn
c. Press the knob briefly
d. Press and hold.

By pressing and turning the knob you can select the various modes of operation of the AR2. As you turn the knob while holding it in, the display will show the current selected mode. Release the knob to choose that selection.

The modes are as follows:

1. **Normal receive mode**. This mode operates much like the old AR1, allowing the jog dial to select frequencies within the aircraft band to listen to. The display shows both frequency and the field strength of the signal (RSSI).
2. **Lighting Control Mode.** This mode allows a user to access an external circuit to remotely control runway lights in small airports by keying the radio at the frequency to which the AR2 is set.
3. **Full Scanner Mode.** This mode operates like normal receive mode but will scan for the next frequency that opens the squelch when you press the knob briefly.
4. **Scanner 1 Mode.** This mode allows you to scan up to 20 frequencies saved in the Scanner 1 Setup mode.
5. **Scanner 2 Mode.** This mode allows you to scan up to 20 frequencies saved in the Scanner 2 Setup mode.
6. **Scanner 3 Mode.** This mode allows you to scan up to 20 frequencies saved in the Scanner 3 Setup mode.
7. **Scanner 4 Mode.** This mode allows you to scan up to 20 frequencies saved in the Scanner 4 Setup mode.
8. **Scanner Skip Mode.** This mode operates like Mode 2, except that it skips automatically to the next active frequency after a specified period of time that you've preset in the skip timer setup screen.
9. **Skip Scanner 1 Mode.** This mode allows you to scan up to 20 frequencies saved in the Scanner 1 Setup mode, only this will

automatically skip to the next frequency after a specified time.

10. **Skip Scanner 2 Mode.** This mode allows you to scan up to 20 frequencies saved in the Scanner 2 Setup mode, only this will automatically skip to the next frequency after a specified time.
11. **Skip Scanner 3 Mode.** This mode allows you to scan up to 20 frequencies saved in the Scanner 3 Setup mode, only this will automatically skip to the next frequency after a specified time.
12. **Skip Scanner 4 Mode.** This mode allows you to scan up to 20 frequencies saved in the Scanner 4 Setup mode, only this will automatically skip to the next frequency after a specified time.
13. **Setup Scanner 1 Mode.** Allows you to save and delete frequency memories from scanner 1.
14. **Setup Scanner 2 Mode.** Allows you to save and delete frequency memories from scanner 2.
15. **Setup Scanner 3 Mode.** Allows you to save and delete frequency memories from scanner 3.
16. **Setup Scanner 4 Mode.** Allows you to save and delete frequency memories from scanner 4.
17. **Setup skip timer.** Allows you to select the amount of time to keep a particular frequency active before skipping to the next active frequency.
18. **Lighting timeout.** This allows setting of the time the lights in the Lighting Control mode are kept on before turning them back off again.

Receive Mode Controls:
Use the jog dial to select the current frequency. The faster you turn the knob, the faster the frequency will change due to a built in accelerator function.

Press and hold the jog dial for two seconds to save this as the default power on mode.

Lighting Mode Controls:
Use the jog dial to select the frequency you wish to use for remote keying control of the lighting system before entering Lighting Control Mode.

Press and hold the jog dial for two seconds to save this as the default power on mode.

Full Scanner Mode and skip mode.
Use the jog dial to select a frequency.

Press and release the knob to skip to the next active frequency.

Skipping to the next channel will occur after timeout in skip mode only.
Standard Scanner Modes 1-4 and skip modes:
Use the jog dial to select a frequency other than what is currently running.

Press and release the jog dial to skip to the next active memory

Press and hold the jog dial to prevent stopping at this frequency for the duration of the selection of this mode.

Skipping to next channel will occur after timeout in skip mode only.

Setup Scanner Modes 1-4
Use the jog dial to select frequencies

If the frequency is already in the list, a + sign will appear in the lower right to indicate it is already in the list. – if it is not.

Press and release the jog dial to add a frequency not in the list
Press and release the jog dial to remove a frequency from the list.

Press and hold the jog dial for two seconds to save your selections to FLASH.

Setup Skip Timer
Use the jog dial to select an appropriate time to stay on any particular frequency before skipping to the next.
Press and hold the jog dial to save the changes to FLASH.

Setup Lighting Timer
Use the jog dial to select an appropriate time out value which determines how long the lights are left on before shutting off.

Press and hold the jog dial to save the changes to FLASH.

CONCLUSION

We sincerely hope that you will enjoy the use of this Ramsey product. As always, we have tried to compose our manual in the easiest, most “user friendly” format possible. We value your opinions, comments, and additions you’d like to see in future publications. Please submit comments or ideas to:

Ramsey Electronics Inc. or email us at techsupport@ramseymail.com
Attn. Hobby Kit Department
590 Fishers Station Drive
Victor, NY 14564
And once again, thanks from the folks at Ramsey!

If you enjoyed this Ramsey product, there are plenty more to choose from in our catalog - write or call today!

These pages intentionally left blank.

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! However, customer satisfaction is our goal, so in the event that you do have a problem, take note of the following.

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 incred bly high reliability levels, and its 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 uF"). Often times, common sense will solve a mysterious missing part problem. If you're missing five 10K ohm resistors and received five extra 1K resistors, you can pretty much be assured that the '1K ohm' resistors are actually the 'missing' 10 K parts ("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 $25.00, 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 l ke. 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 $50.00 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.

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Manual Price Only: $5.00
Ramsey Publication No. AR2
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