5010305
377

RX SERIES RECEIVER

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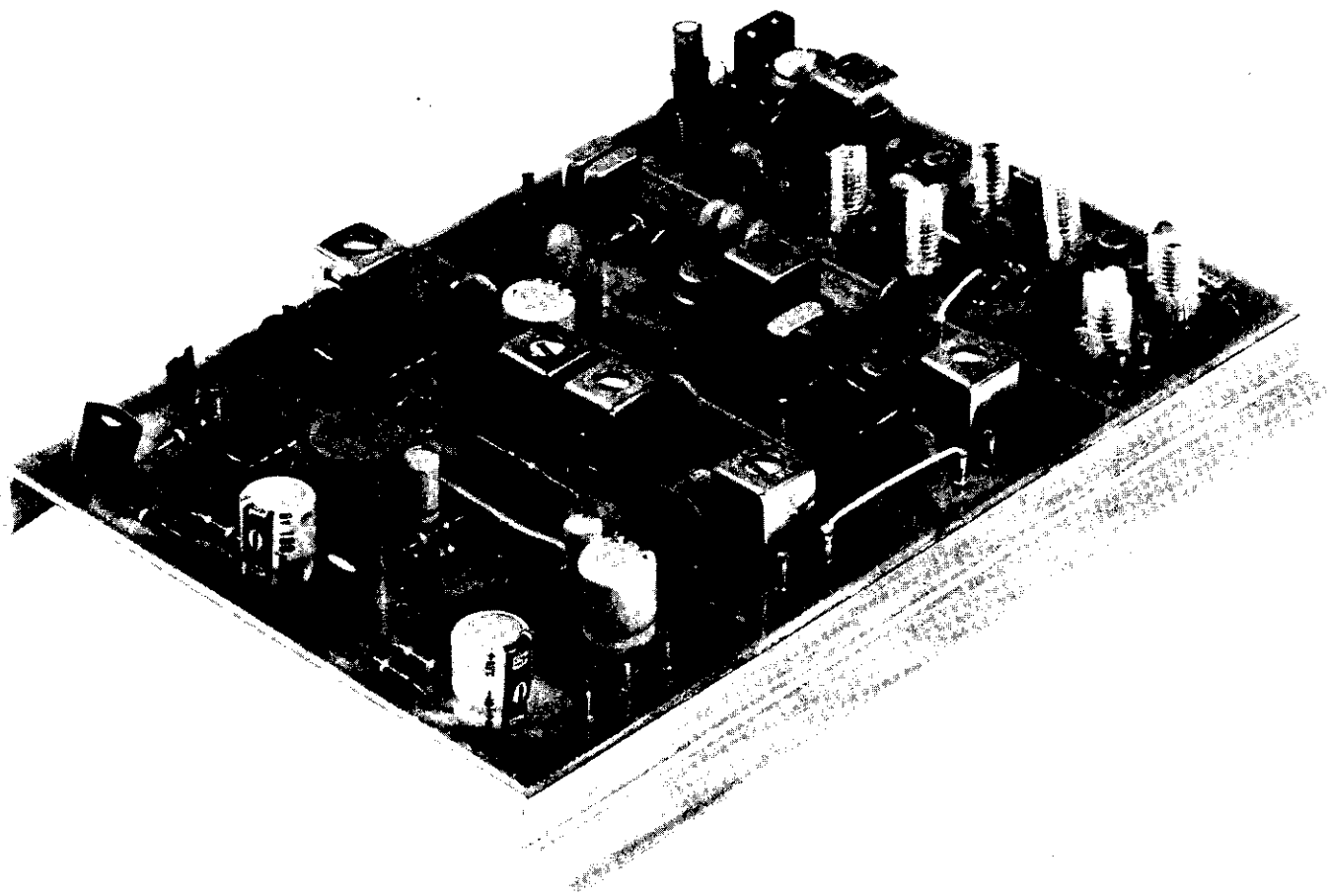


PRICE $3.00

master charge

BANKAMERICARD

Vhf engineering

DIVISION OF BROWNIAN ELECTRONICS CORP.

320 WATER ST. / BINGHAMTON, N.Y. 13901 / Phone 607-723-9574

MODEL TABLE

RX50C	(30-60MHz)	=	RF50	IF10.7F*	FM455A	AS-2
RX144C	(140-170MHz)	=	RF144D	IF10.7F*	FM455A	AS-2
RX220C	(210-250MHz)	=	RF220D	IF10.7F*	FM455A	AS-2
RX432C	(410-470MHz)	=	RF432	IF10.7F*	FM455A	AS-2

*Filter supplied gives 3 DB at ±7.5Khz 40 DB at ±30Khz
RXCF filter option gives 3 DB at ±7.5Khz 70 DB at ±30Khz

All models available with RF tight enclosure, volume, squelch controls, and antenna connector. Add suffix "M" to receiver name (example: RX144CM).

CD-1 A ten channel diode switched add-on crystal deck for RX-50, RX-144, and RX-220.

CD-3 Same as CD-1 except with pin diodes for use on RX-432.

SC-3 A ten channel scanner for use with all models.

LIMITED WARRANTY

Factory wired units are warranted for one year. The unit must be returned to the factory postpaid with a note describing difficulty and date of purchase. Include a check to cover return postage. Our liability under warranty is limited to repair, adjustment or replacement of units proven to be defective. No further warranty is expressed or implied. Units modified or obviously misused will not be covered by the warranty.

The parts in a kit built according to our instructions carry the original manufacturers' warranty. Defective parts must be returned for credit. Units wired from kits may be returned to the factory for repair and alignment for a nominal charge, plus parts and shipping. No further warranty is expressed or implied. Units not built according to our instructions will be subject to additional charges for repair and/or alignment. Units used in custom installations are not warranted for overall specifications.

SPECIFICATIONS

* Receiver current drain: 60 ma squelched (12.6 volts negative ground).
  300 mils with maximum audio

* All integrated circuitry except RF board

* Typically .2 uv squelch sensitivity (slightly less at 220 & 432 range)

* Dual conversion: 1st = 10.7 Mhz, 2nd = 455 Khz

* 15 Khz bandwidth (subject to optional filter employed)

* Multi-channel operation with suitable crystal selector switch

* COR output for scanner or repeater control

* Test points provided for S meter and frequency discriminator

* 2 watts maximum into a speaker load range of 4 to 16 ohm

* Dimensions: Four Modules $1\frac{1}{2}$" X 4" each - overall 4" X 6" X 1"
  (RF432 2" X 4" - RX432 4" X $6\frac{1}{2}$" X 1")

* Crystal information: All units use third overtone types cut at 20pf parallel in HC-25U holders. Frequency is determined as follows:

30-45 MHz = Freq. + 10.7 45-60 MHz = Freq. - 10.7

$$140\text{-}170 \text{ MHz} = \frac{\text{Freq.} - 10.7}{3} \qquad 210\text{-}250 \text{ MHz} - \frac{\text{Freq.} - 10.7}{4}$$

$$410\text{-}470 \text{ MHz} = \frac{\text{Freq.} - 10.7}{9}$$

Thank you for purchasing this VHF Engineering kit. We hope you will get as much pleasure and satisfaction out of building and using this unit as we have from designing it for you. Please read all of the enclosed material carefully. Unlike kits which are produced for the general public, this kit was designed for the ham who has some homebrew experience and technical knowledge. If you encounter problems in alignment or testing, don't hesitate to obtain assistance from a fellow ham near you or here at VHF Engineering.

Bob Brown W2EDN | Will Kupfrian W2BVA | Marvin Druskoff K2VIV

The construction techniques and proceedures in this manual are very important to the proper and easy building of VHF Engineering kits. If your previous experience has been with unminiaturized equipment the following information should prove invaluable. To build miniaturized equipment using P.C. boards requires extra patience and care, normal dexterity, and the proper tools for the job.

GENERAL NOTES

A. A good soldering job is essential to the satisfactory performance of this unit. Soldering to etched circuit boards is easier than conventional point to point wiring when it is done correctly.

Use rosin core solder only. Acid core solder or paste fluxes will cause corrosion and void all warranties. Use a clean, freshly tinned soldering iron of about 30-35 watts. (A controlled temperature type is preferred).

When soldering a part to the P.C. board, the solder must completely surround the wire lead where it comes through the board. Do not apply excessive solder, but do not hesitate to apply sufficient heat to assure a smooth flow of solder all around the lead and onto the board. Do not worry about overheating semiconductors. It is likely that P.C. board lands will be lifted long before a semi-conductor device is damaged.

B. Leads on resistors, capacitors, transistors etc. are often longer than required. These leads should be trimmed as short as possible unless specific directions to the contrary are given in the instructions.

As a general rule all parts should be mounted as close to the board as possible. In the case of capacitors it may be necessary to scrape the body coating off of the leads to allow the bottom of the capacitor to rest on the board.

C. Inspect your work after each step and check off the steps as they are completed. You will find it helpful to check off capacitors, resistors etc. on the parts list as they are installed. This will save you time and mistakes.

D. Check and double check the direction in which polarized components should be installed. In particular, take great care when inserting transistors, I.C.'s, electrolytic and tantalum capacitors etc. Remember the old carpenters rule "Measure twice and cut once".

PARTS IDENTIFICATION

In order to expidite delivery to you, we are occasionally forced to make minor substitutions of parts. For example; 4.7 MFD for 5 MFD; .022 MFD for .02 MFD. Such substitutions are carefully checked before they are approved and the parts supplied will function satisfactorily. These changes are usually self-evident and are mentioned here only to prevent confusion in checking the contents of your kit.

Each manufacturer seems to have his own method of marking for similar parts. In order to eliminate confusion about reading values marked on components, the following examples are presented.

DISC CERAMIC CAPACITORS - value and a tolerance letter printed on body. For example: 2.2C=2.2PF ± 1/4pf; 5D=5pf ± 1/2pf; 12J=12pf ± 5%; 680K=680pf ± 10%; 1000p=.001 Mfd. Please note that the letters on capacitors do NOT denote a multiplier, they indicate tolerance only.

SILVER MICA CAPACITORS - value and tolerance are coded on the body of the device. For example: 220J03=22pf ±5%; 330J03=33pf ±5%; 221J03=220pf ±5%; 331J03=330pf ±5%. Actual value may also be printed on the body. This should be self-evident.

ELECTROLYTIC AND TANTALUM CAPACITORS - the value is printed on the body of the device. There are several shapes and sizes the only odd one which we use is a tantalum which is shaped like a drop of water. BE SURE THAT YOU OBSERVE POLARITY MARKINGS.

RESISTORS - are color coded. Be very careful, when reading codes, not to confuse red and orange, brown and orange, violet and grey etc.

R.F. CHOKES - read color code as follows:

1. Start reading from wide silver band.
2. The next group of bands indicate significant figures.
3. When a gold band appears in the significant figure grouping it should be read as a decimal point.
4. Last band indicates tolerance: gold=5% silver=10% None=20%

Examples:

wide silver/ gold/ orange/ orange = .33 uhy 20%
wide silver/ brown/ black/ black/ gold = 10 uhy 5%
wide silver/ blue/ grey/ brown/ gold = 680 uhy 5%
wide silver/ yellow/ gold/ purple/ silver = 4.7 uhy 10%

COIL WINDING: Follow our coil data exactly as given in the main part of this manual. When counting turns, be very careful to start with the first complete turn and not the second. For example: when a 3 1/2 turn coil is completed if you look at one side of the coil you will count 3 turns and looking at the other side you will count 4. Be very careful to wind all coils in the same direction.

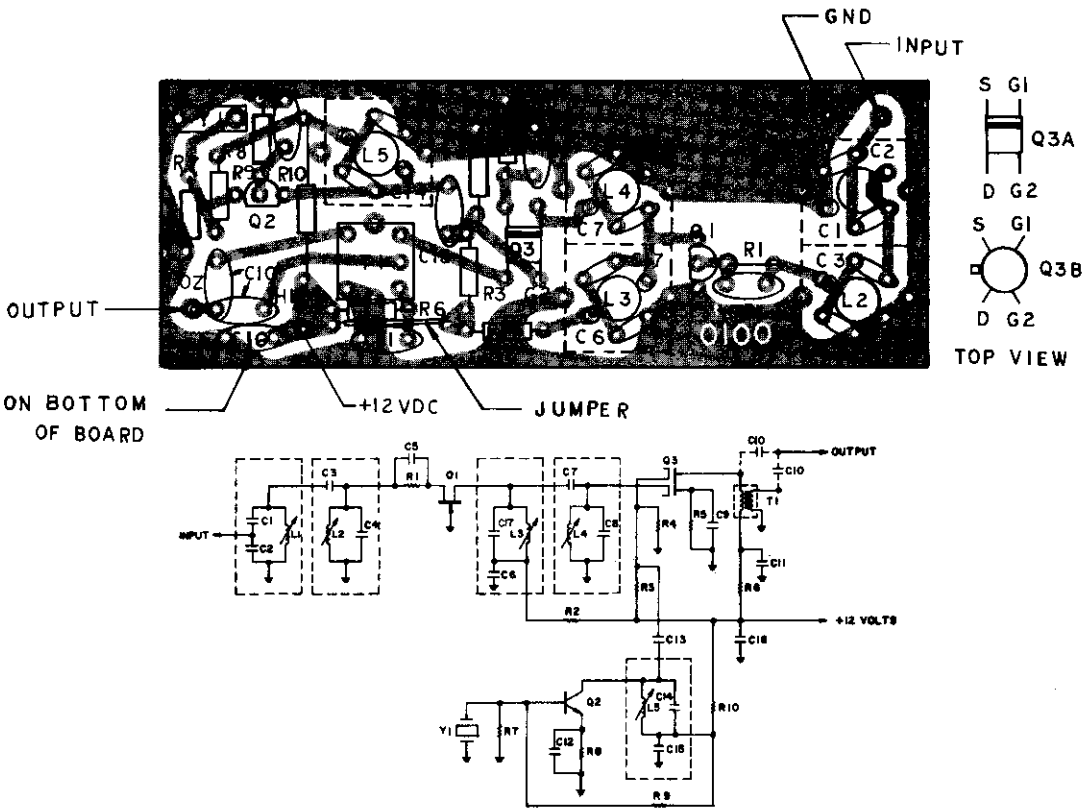
RF-50

KIT 7010280
WIRED 7010281

C1	20pf	(2010110)	R1	270	(2020150)
	*47pf	(2010190)	R2	47	(2020080)
C2	47pf	(2010190)	R3	47K	(2020390)
	*100pf	(2010250)	R4	4.7K	(2020290)
C3	1pf	(2010010)	R5	100	(2020100)
	*2.2pf	(2010030)	R6	47	(2020080)
C4	15pf	(2010090)	R7	4.7K	(2020290)
	*30pf	(2010160)	R8	1K	(2020230)
C5	.005	(2010390)	R9	10K	(2020330)
C6	.005	(2010390)	R10	47	(2020080)
C7	1pf	(2010010)			
	*2.2pf	(2010030)	Q1	2N5486	(1020120)
C8	15pf	(2010090)		or MPF102	(1020009)
	*30pf	(2010160)	Q2	2N5222	(1020110)
C9	.005	(2010390)	Q3	MPF122	(1020020)
C10	.022	(2010430)		or MPF121	(1020010)
C11	.005	(2010390)		or 3N204	(1020030)
C12	47pf	(2010190)			
C13	1pf	(2010010)	L1-L5	10½T #24	
	*2.2pf	(2010030)		7/32 D (Brown)	(2030030)
C14	20pf	(2010110)			
	*15pf	(2010090)		10.7IF Coil	
C15	.005	(2010390)		(Green)	(2030150)
C16	.005	(2010390)			
C17	15pf	(2010090)		Coil Shields	(2030090)
	*30pf	(2010160)		Keystone Pins	(4060130)
				PC Board	(4040010)
				Manual	(5010401)

First Value 45-60 MHz operating frequency
* 30-45 MHz " "

Crystal Information: 30-45 MHz = Freq. + 10.7
45-60 MHz = Freq. - 10.7
Third overtone, parallel at 20pf, HC-25/U holder.



RF-50

A high gain low noise front end that provides better then .2 uv squelch sensitivity. The image rejection is better then 60 db. The IF rejection better then 100 db. The front end may be staggered tuned to a band-pass greater then 6 Mhz at the 3 db points.

ASSEMBLY

Mount all components on the circuit board as shown above. All components should be mounted as close to the board as possible. The insulation around the capacitor leads may have to be scraped to allow close mounting. The two condensors adjacent to each coil are housed by the coil shield. C-10 may be inserted in one of two positions in order to select the output impedance. The IF-10.7 requires a high impedance (nominal 3K ohm therefore mount the capacitor lengthwise on the board. Mounting the capacitor crosswise on the board selects a low output impedance. (nominal 600 ohm) Capacitor values in parenthesis are for the 30-45 Mhz range. C-14 is 20 p for crystals in the 30-45 Mhz range and 15 p for crystals in the 45-60 Mhz range.

TUNING

The RF-50 may be tuned to cover any four Mhz range between 30-60 Mhz. Normally L-1 through L-4 are peaked on one frequency for maximum sensitivity. They may be staggered tuned to provide a band-pass greater then 4 Mhz.

After connecting power check the RF voltage at gate 2 of Q-3 with an RF voltmeter or probe and a VOM. Adjust L-5 for maximum voltage. Turn the power off and on to make sure the oscillator starts each time. Connect a signal generator tuned to the channel frequency to the antenna terminal. Decrease the output until some background noise is heard in the speaker. Peak L-1 through L-4 for best quieting while keeping the signal just into the noise.

When the receiver is to be multi-channeled on frequencies seperated by more then 2 Mhz the coils may be staggered tuned. Tune as above except L-1 and L-3 are peaked on one frequency and L-2 and L-4 are peaked on the other frequency. This procedure is usually adequate. A more exacting procedure is to use a sweep generator and oscilliscope. Connect the sweep to the antenna terminal and a demodulator probe to the output pin of the RF board. Adjust L-1 through L-4 for the required band-pass.

RF 144D

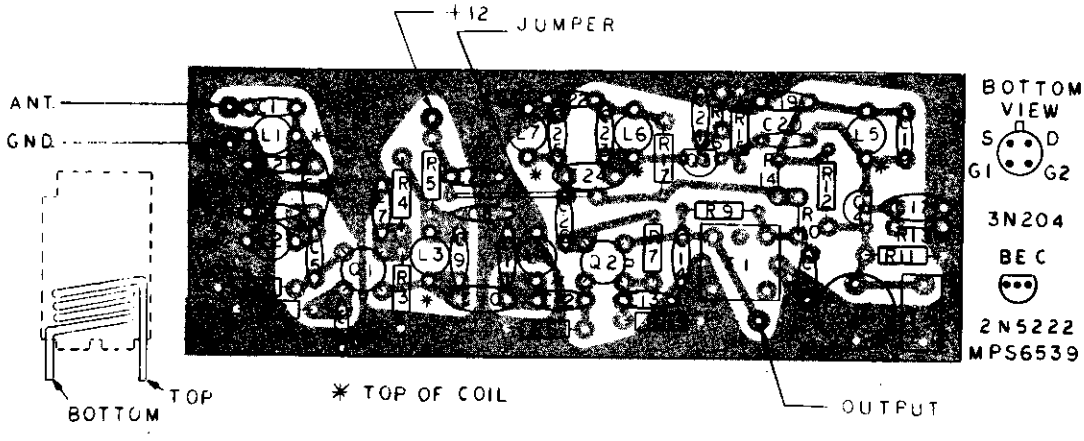
(Kit 7010290)
(Wired 7010291)

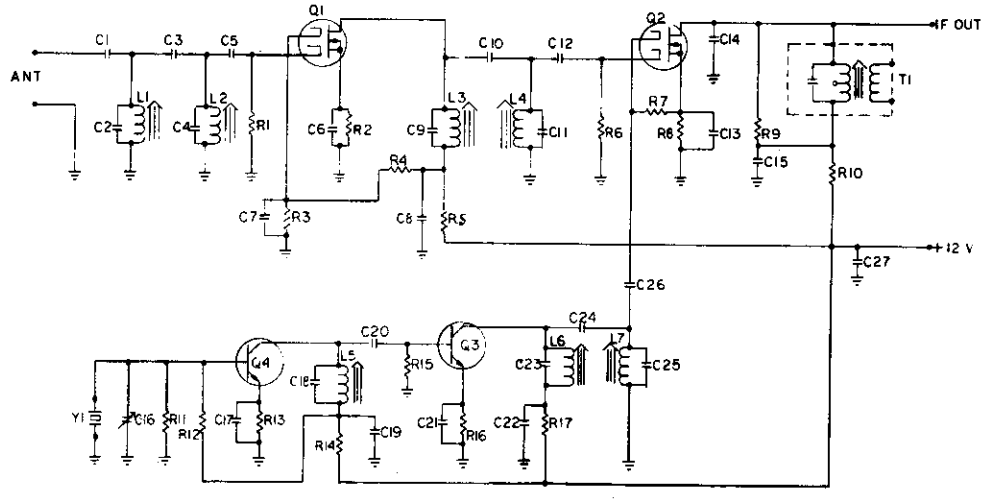
R1	47K	(2020390)
R2	330	(2020170)
R3	22K	(2020360)
R4	100K	(2020410)
R5	100	(2020100)
R6	47K	(2020390)
R7	100K	(2020410)
R8	330	(2020170)
R9	3.3K	(2020271)
R10	100	(2020100)
R11	4.7K	(2020290)
R12	10K	(2020330)
R13	1K	(2020231)
R14	100	(2020100)
R15	1K	(2020231)
R16	330	(2020120)
R17	100	(2020100)

L1-L4, L6-L7	White Coil	(2030060)
L5	Brown	(2030075)

Q1	3N204	(1020030)
Q2	3N204	(1020030)
Q3	2N5222	(1020110)
	or MPS6539	(1020160)
Q4	2N5222	(1020110)
	or MPS6539	(1020160)
T1	10.7MHz Green Coil	(2030150)
Y1	Crystal Socket	(4080050)
4	Keystone Pins	(4060130)
1	PC Board	(4040021)
1	Instruction Sheet	(5010410)

C1	3.3pf	(2010040)
C2	10pf	(2010070)
C3	1pf	(2010010)
C4	10pf	(2010070)
C5	27pf	(2010150)
C6	.001	(2010370)
C7	.001	(2010370)
C8	.001	(2010370)
C9	10pf	(2010070)
C10	1pf	(2010010)
C11	10pf	(2010070)
C12	27pf	(2010150)
C13	.001	(2010370)
C14	10pf	(2010070)
C15	.005	(2010390)
C16	20pf Var.	(2010650)
C17	47pf SM	(2010191)
C18	20pf NPO	(2010110)
C19	.005	(2010390)
C20	10pf	(2010070)
C21	.001	(2010370)
C22	.001	(2010370)
C23	10pf	(2010070)
C24	1pf	(2010010)
C25	10pf	(2010070)
C26	5pf	(2010050)
C27	.005	(2010390)





CIRCUIT DESCRIPTION

The RF144D is a high gain low noise receiver front end that covers 140-170 MHz with better than .3uV squelch sensitivity. Total gain is over 40DB. The RF and mixer transistors are zener protected dualgate mosfets. The oscillator and multiplier stages use bipolar NPN transistors. The oscillator operates at 1/3 the injection frequency and uses a crystal in the 45 MHz range (third overtone type HC-25/U, parallel resonance at 20pf).

The multiplier stage triples the oscillator frequency for injection into the mixer. A trimmer is provided across the crystal to allow slight adjustment of the receive frequency (3 KHz typical). The trimmer should be removed when using the CD-1 multichannel deck. The output is high impedance to match the crystal filter located on the 10.7 MHz IF board.

TUNING

The RF board is normally tuned connected in a receiver configuration with other boards. It may be tuned separately by using a scope or RF voltmeter to indicate maximum output.

The oscillator is tuned first by connecting a voltmeter across R-16 (negative lead to ground, positive lead to top of R-16) and adjusting L-5 for maximum voltage (3-6 volts). Remove and reapply power to make sure the oscillator will start each time. If the oscillator does not start or is sluggish, readjust L-5 slightly off peak. Apply a signal to the antenna terminals and tune L1-L4 and L6-L7 for maximum sensitivity or output. The tuning should be repeated several times to assure maximum sensitivity.

ASSEMBLY

It is important to install all capacitors as close to the board as possible. If necessary, remove the excess coating from the capacitor leads to allow the capacitor to sit on the board. Install the capacitor and resistors as shown on the layout. It is advisable to install adjacent parts before soldering to prevent the solder from plugging up the empty holes. The coils should be installed with the top of the winding connected to the hole marked with the asterisk. The transistors should be installed with no more than 1/8" lead length. Install the crystal socket and connector pins. Carefully go over the foil side of the board looking for solder bridges or cold solder connections.

RF220D

(Kit 7010300)
(Wired 7010301)

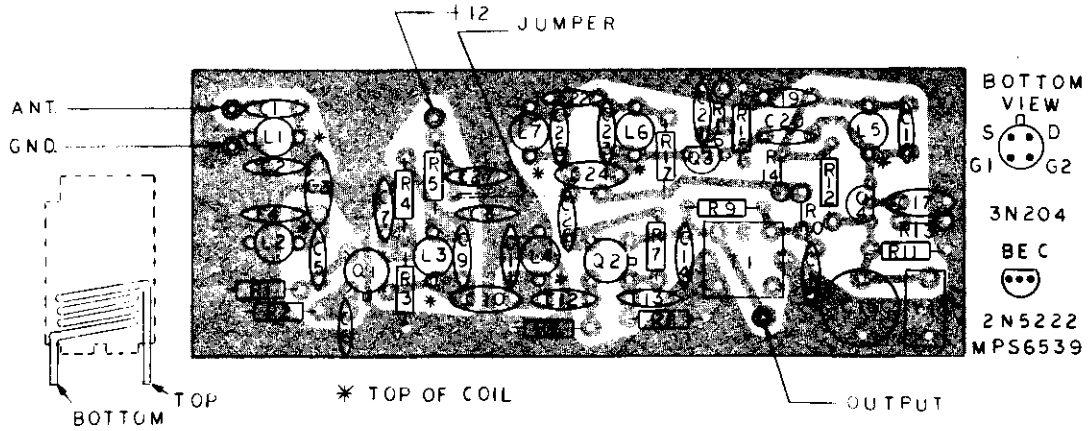
R1	47K	(2020390)
R2	330	(2020170)
R3	22K	(2020360)
R4	100K	(2020410)
R5	100	(2020100)
R6	47K	(2020390)
R7	100K	(2020410)
R8	330	(2020170)
R9	3.3K	(2020271)
R10	100	(2020100)
R11	4.7K	(2020290)
R12	10K	(2020330)
R13	1K	(2020231)
R14	100	(2020100)
R15	1K	(2020231)
R16	330	(2020120)
R17	100	(2020100)

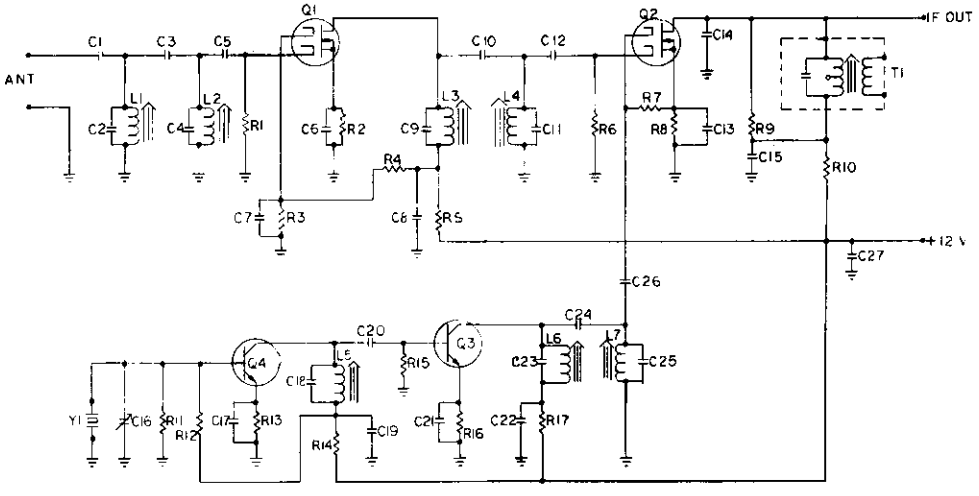
L1-L4, L6-L7	Red Coil	(2030220)
L5	Brown Coil	(2030075)

Q1	3N204	(1020030)
Q2	3N204	(1020030)
Q3	2N5222	(1020110)
	or MPS6539	(1020160)
Q4	2N5222	(1020110)
	or MPS6539	(1020160)
T1	10.7MHz Green Coil	(2030150)
Y1	Crystal Socket	(4080050)
4	Keystone Pins	(4060130)
1	PC Board	(4040021)
1	Instruction Sheet	(5010411)

C1	2.2pf	(2010030)
C2	5pf	(2010050)
C3	1pf	(2010010)
C4	5pf	(2010050)
C5	22pf	(2010120)
C6	.001	(2010370)

C7	.001	(2010370)
C8	.001	(2010370)
C9	5pf	(2010050)
C10	1pf	(2010010)
C11	5pf	(2010050)
C12	22pf	(2010120)
C13	.001	(2010370)
C14	10pf	(2010070)
C15	.005	(2010390)
C16	20pf Var.	(2010650)
C17	47pf SM	(2010191)
C18	20pf NPO	(2010110)
C19	.005	(2010390)
C20	10pf	(2010070)
C21	.001	(2010370)
C22	.001	(2010370)
C23	5pf	(2010050)
C24	1pf	(2010010)
C25	5pf	(2010050)
C26	3.3pf	(2010040)
C27	.005	(2010390)





CIRCUIT DESCRIPTION

The RF220D is a high gain low noise receiver front end that covers 210-240 MHz with better than .3uV squelch sensitivity. Total gain is over 40DB. The RF and mixer transistors are zener protected dualgate mosfets. The oscillator and multiplier stages use bipolar NPN transistors. The oscillator operates at 1/4 the injection frequency and uses a crystal in the 50MHz range (third overtone type HC-25/U, parallel resonance at 20pf).

The multiplier stage quadruples the oscillator frequency for injection into the mixer. A trimmer is provided across the crystal to allow slight adjustment of the receive frequency (3 KHz typical). The trimmer should be removed when using the CD-1 multichannel deck. The output is high impedance to match the crystal filter located on the 10.7 MHz IF board.

TUNING

The RF board is normally tuned connected in a receiver configuration with other boards. It may be tuned separately by using a scope or RF voltmeter to indicate maximum output.

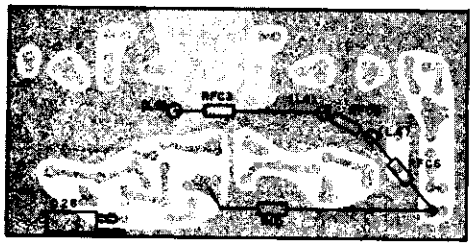
The oscillator is tuned first by connecting a voltmeter across R-16 (negative lead to ground, positive lead to top of R-16) and adjusting L-5 for maximum voltage (3-6 volts). Remove and reapply power to make sure the oscillator will start each time. If the oscillator does not start or is sluggish, readjust L-5 slightly off peak. Apply a signal to the antenna terminals and tune L1-L4 and L6-L7 for maximum sensitivity or output. The tuning should be repeated several times to assure maximum sensitivity.

ASSEMBLY

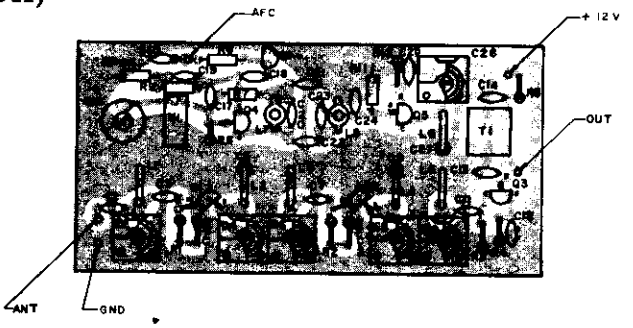
It is important to install all capacitors as close to the board as possible. If necessary, remove the excess coating from the capacitor leads to allow the capacitor to sit on the board. Install the capacitor and resistors as shown on the layout. It is advisable to install adjacent parts before soldering to prevent the solder from plugging up the empty holes. The coils should be installed with the top of the winding connected to the hole marked with the asterisk. The transistors should be installed with no more than 1/8" lead length. Install the crystal socket and connector pins. Carefully go over the foil side of the board looking for solder bridges or cold solder connections.

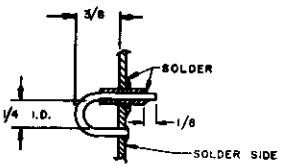
RF432

(Kit 7010310)
(Wired 7010311)



VIEW SHOWING COMPONENTS ON SOLDER SIDE





TYPICAL FEED-THRU CAP.

EMBLY

Insert C5, C9 and C27 through the board from the foil side, as shown on the detail drawing. Solder the ring to the foil side of the board. Be sure to use sufficient heat and solder to assure a clean, solid connection. Care must be taken in this and the following steps that the ceramic capacitor form is not chipped or broken.

a) Preform coils L1, L2, L3, L4, L5 and L6 as shown in the detail drawing. These must have a 1/4" inside diameter and the sides must be exactly parallel.

b) Coils L1, L3 and L5 may be inserted as shown on the component view. Care must be taken to maintain the 3/8" height dimension on these coils. Solder both ends of the coil and trim close to the board.

c) Insert L2, L4 and L6 through the ceramic feed through capacitors as shown in the detail drawing. Adjust each coil to fit the capacitor exactly, and to maintain the 3/8" height. DO NOT FORCE the coil through the capacitor since the ceramic core can be easily broken. Solder both leads of the coil. Trim the leads which pass through the capacitors about 1/8" from the ends of the ceramic core. These will be used as tie points. The other coil leads should be trimmed close to the board.

a) Install the resistors and chokes as shown on the layout. Observe the positioning on the components which stand on end. ALL LEAD LENGTHS MUST BE AS SHORT AS POSSIBLE.

b) Install the capacitors as shown on the parts layout. It may be necessary to remove the coating from the leads near the body in order to set the capacitors down close to the board.

Install the transistors. Preform the leads to conform to the holes in the P.C. board and orient exactly as shown on the parts layout. DO NOT USE SOCKETS. The transistor body must be as close as possible to the P.C. board surface.

Install the keystone pins (5 places)

Cut the small plastic tab off the bottom of both white slug tuned coils. Install these at L7 and L8 with the sides from which the tab was removed facing towards Q4.

Install the crystal socket at Y1, capacitor C16 and transformer T1 as shown.

Install five air variable capacitors at C2, C4, C6, C8, C10, and C25. Orient these capacitors with the movable rotor on the ground side of the circuit as shown in the parts layout.

a) Install RFC3, RFC5, RFC6 and R10 on the foil side of the board. Use the ends of the coils which extend beyond feed through capacitors C5, C9 and C27 as solder lugs. Do not use excess solder. Be careful to avoid shorted leads and solder bridges.

b) Install C28 on the foil side of the board. + to the AFC pin, and - to ground. The leads should be as short as possible.

This completes the assembly of the RF432 Module. Recheck all ponent values and inspect the board carefully for cold solder joints, ges or other wiring errors.

CIRCUIT DESCRIPTION

The RF-432 is a high gain, low noise receiver front end that covers 420-470MHz with better than .3uV squelch sensitivity. Total gain is over 30 dB with a nominal 5dB noise figure. The two RF stages (Q1, Q2) use a low noise junction FET in a grounded gate configuration. The mixer FET (Q3) is a common source configuration with local oscillating injection by inductive coupling between L-5 and L6.

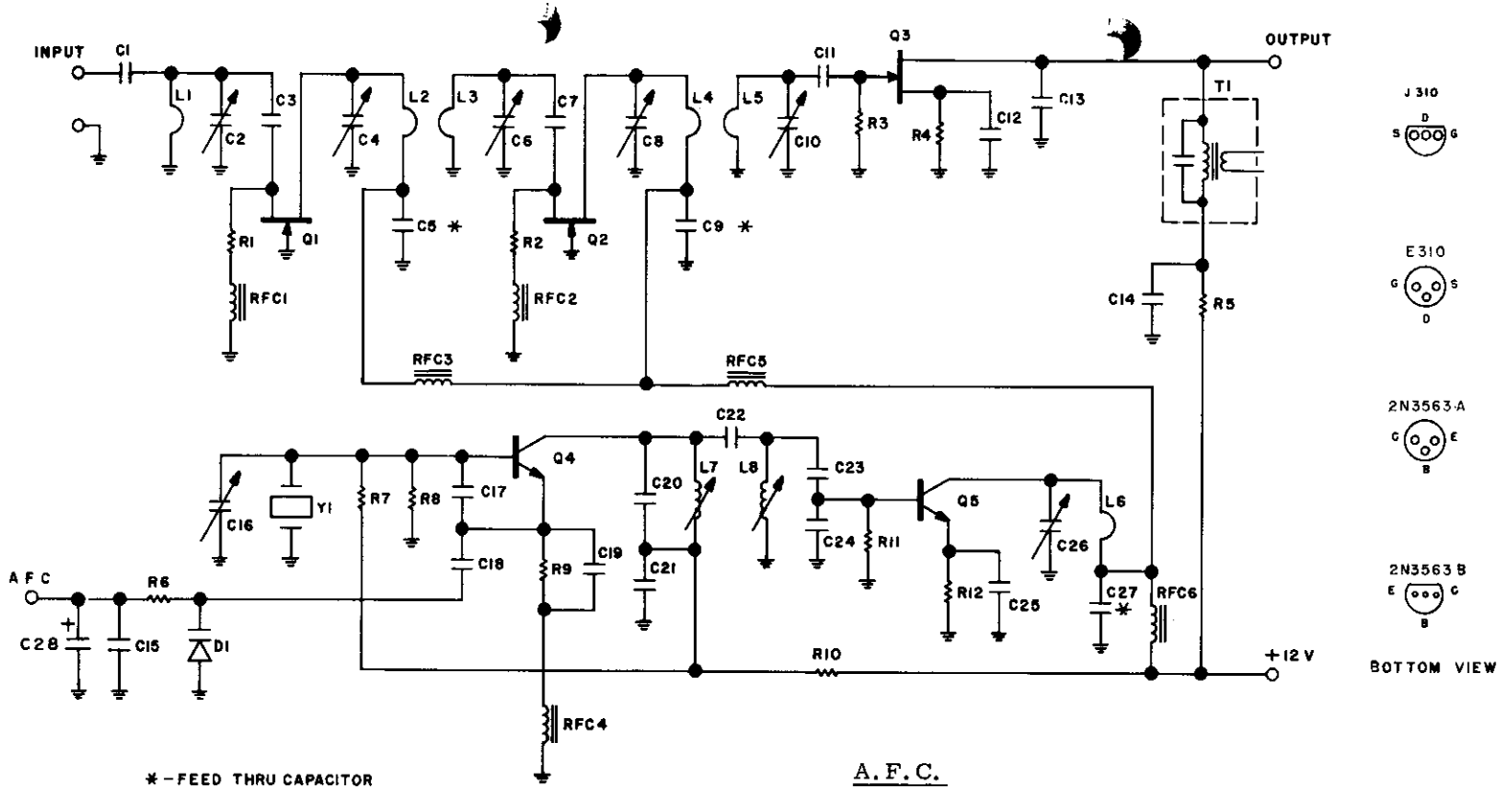
The oscillator transistor (Q4) is a modified Colpitts requiring a 3rd overtone crystal in the 45-51MHz range (ground parallel at 20pf, in a HC-25 V holder). The oscillator collector circuit is tuned to the crystal's third harmonic. The varactor in the emitter circuit allows the discriminator voltage to tune the crystal frequency to allow the oscillator to track received signals. The multiplier transistor (Q5) triples the output of the oscillator resulting in a total multiplication of 9 for injection into the mixer.

The 10.7 MHz IF output is high impedance to match the filter located on the 10.7 board. For other applications, the low impedance secondary of T1 may be used.

RF 432
PARTS LIST

C1	10pf	(2010070)	R1	10ohm	(2020100)
C2	10pf Air Var.	(2010620)	R2	100	(2020100)
C3	10pf	(2010070)	R3	47K	(2020390)
C4	10pf Air Var.	(2010620)	R4	2.2K	(2020260)
C5	500pf FT	(2010340)	R5	47	(2020080)
C6	10pf Air Var.	(2010620)	R6	10K	(2020330)
C7	10pf	(2010070)	R7	10K	(2020330)
C8	10pf Air Var.	(2010620)	R8	4.7K	(2020290)
C9	500pf FT	(2010340)	R9	470	(2020190)
C10	10pf Air Var.	(2010620)	R10	47	(2020080)
C11	22pf	(2010120)	R11	1K	(2020230)
C12	.001	(2010370)	R12	100	(2020100)
C13	10pf	(2010070)			
C14	.005	(2010390)	Q1	E310 or J310	(1020040)
C15	.001	(2010370)	Q2	E310 or J310	(1020040)
C16	22pf Ceramic Var.	(2010650)	Q3	E310 or J310	(1020040)
C17	33pf	(2010180)	Q4	2N3563A or 2N3563B	(1030020)
C18	.001	(2010370)	Q5	2N3563A or 2N3563B	(1030020)
C19	.001	(2010370)			
C20	10pf	(2010070)	T1	10.7 IF Coil (green)	(2030150)
C21	.001	(2010370)			
C22	2.2pf	(2010030)	L1	#14 Wire ½T	(3030080)
C23	15pf	(2010090)	L2	#14 Wire ½T	(3030080)
C24	47pf	(2010190)	L3	#14 Wire ½T	(3030080)
C25	.001	(2010370)	L4	#14 Wire ½T	(3030080)
C26	10pf Air Var.	(2010620)	L5	#14 Wire ½T	(3030080)
C27	500pf FT	(2010340)	L6	#14 Wire ½T	(3030080)
C28	4.7 Mfd 16V Elec.	(2010490)	L7	3½ Turns (white)	(2030060)
			L8	3½ Turns (white)	(2030060)
D1	MV2112	(1010029)			
			RFC1	10 uh Choke	(2040050)
1	Board	(4040040)	RFC2	10 uh Choke	(2040050)
1	Crystal Socket	(4080050)	RFC3	10 uh Choke	(2040050)
1	Manual	(5020305)	RFC4	4.7 uh Choke	(2040040)
5	Keystone Pins	(4060130)	RFC5	10 uh Choke	(2040050)
1 ft.	#14 Tubing	(3050330)	RFC6	10 uh Choke	(2040050)

Crystal Formula: Receive frequency minus 10.7, divide by 9, parallel resonate at 20p., HC-25/U holder. Example: 446.0 requires a 48.3666.



* - FEED THRU CAPACITOR

TUNING

1.) Preset all trimmers to 1/2 Mesh.

2.) Apply power +12 volts to 12V pin.
If the module is not being used with the RX series, the AFC pin must have a bias voltage of 6 volts applied (see "AFC" section).

3.) Connect the positive probe of a VOM or VTVM to the top of R12. Adjust L7 and L8 for maximum voltage indication (approximately .4-.5 volts).

4.) Connect the probe to the top of R4. A voltage of 2.5 to 3.5 volts should be present at this point. Adjust C26 for a peak reading. The change from minimum to maximum voltage will be rather small during this adjustment.

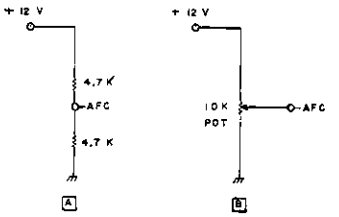
5.) Apply a signal on the desired channel frequency to the input of the module. Adjust the remaining trimmers for maximum sensitivity. Trimmers C2 and C6 will tune rather broadly. The remaining trimmers should exhibit a fairly sharp peak when adjustments are made.

6.) Repeak all trimmers and coils for maximum overall sensitivity. Repeat these adjustments until no further improvement can be achieved.

A.F.C.

The AFC tunes the crystal oscillator (within limits) to track the received signal. The maximum range is about 3 KHz. The AFC input is connected to Test Point "B" on the FM455 board. If the AFC feature is not needed, or the RF-432 is used as a converter, a voltage divider consisting of two 4.7K resistors from +12 volts should be connected to the AFC input to provide 6 volts bias for the varactor (see diagram "A"). A 10K pot may be used to allow front panel adjustment of the local oscillator (see diagram "B").

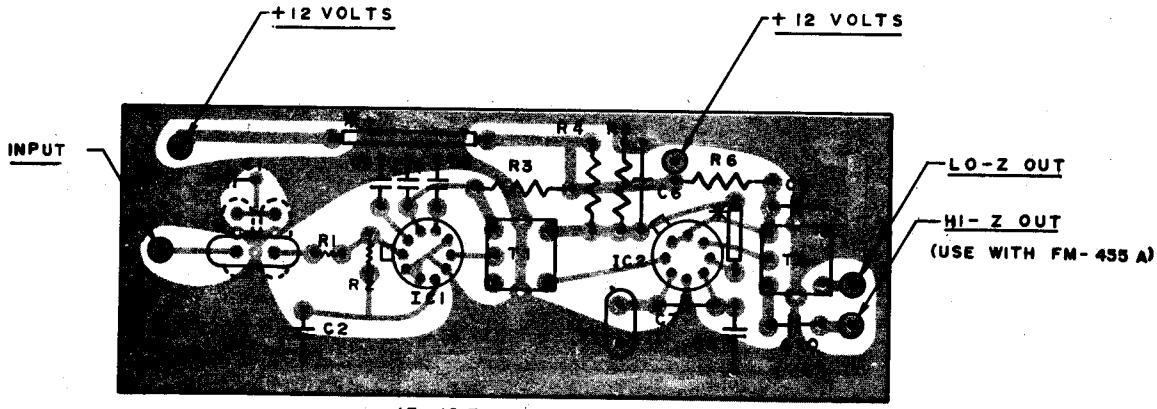
Note: The IF 10.7 must use a 10.245 MHZ crystal for AFC to operate correctly. If a 11.155 crystal is needed to eliminate birdies or image reception, use optional AFC board to invert or reverse AFC action.



IF 10.7

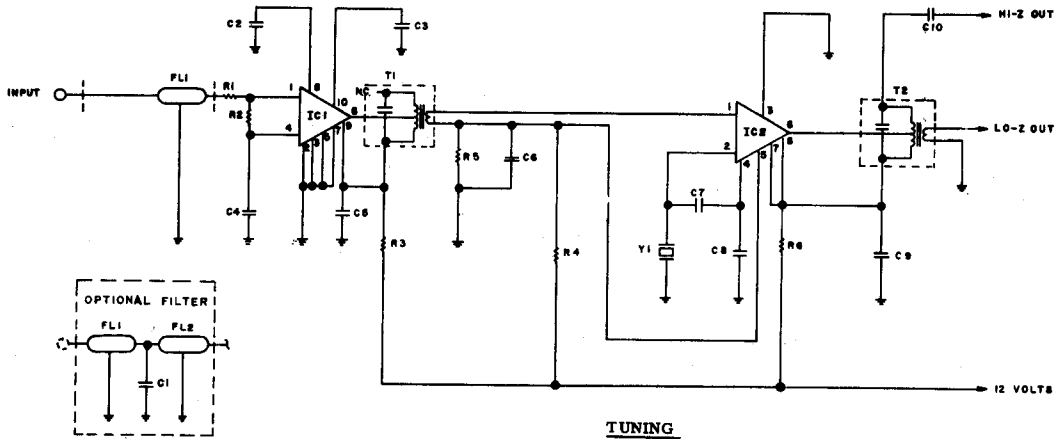
(Kit 7010320)
(Wired 7010321)

*C1	3.3pf (2010040)	R1	2.2K (2020260)
C2	.02 (2010430)	R2	1K (2020230)
C3	.02 (2010430)	R3	1K (2020230)
C4	.02 (2010430)	R4	560 ohm (2020210)
C5	.02 (2010430)	R5	1.2K (2020250)
C6	.1 (2010440)	R6	100 ohm (2020100)
C7	68pf SM (2010220)		
C8	220pf SM (2010310)	IC1	MC1550G (1050040)
C9	.1 (2010440)	IC2	LM or CA3053 (1050080)
C10	10pf (2010070)		
		Y1	11.155 or 10.245 (2311155 or 2310245)
FL1	HD4410 (2070020)	T1	10.7 IF can (green) (2030150)
*FL2	HD4410 (2070020)	T2	455 IF can (yellow) (2030130)
		6	Keystone Pins (4060130)
*Used with RXCF option only		1	P.C. Board (4040050)
(70DB rejection at 30 Khz)		1	Instruction Sheet (5010405)
(40DB rejection at 15 Khz)			



IF-10.7 COMPONENT VIEW

* = JUMPER (2) PLACES.



IF-10.7

A 10.7 mhz IF amplifier using a MC-1550 IC and a crystal controlled converter with 455 khz output, using a CA-3028A IC. The over-all gain is greater than 50 db. The 455 khz output may be taken off the low impedance winding or high impedance capacity coupled output normally used for the IF-455 board. A crystal filter input is sued to provide the required selectivity. The RXCF option provides greatly increased selectivity by using two filters in series.

ASSEMBLY

It is easier to install the IC's first. The leads of the IC's can be cut to different lengths to make installation easier. Be sure the metal tabs are properly oriented before soldering. The metal tabs on T1 and T2 should be bent over before soldering. The two jumper wires may be bare or insulated wire. C1 is used for the RXCF option only.

TUNING

The IF-10.7 module may be tuned by itself with a signal generator and RF probe. A 10.7 mhz signal is applied to the input and ground through a .01 capacitor. The RF probe is connected to the output and ground. With twelve volts applied, adjust T1 and T2 for maximum output. If the module is used with RF, and FM-455 modules, alignment is easily accomplished by applying a 10.7 mhz signal to gate 1 of Q2 on the RF board. All the IF cans are tuned for maximum output. Be sure to keep the input signal into the notes to prevent the detector chip from limiting.

MOUNTING

The boards can be mounted on a chassis or metal plate with 4-40 screws and 1/4 inch spacers. The holes in the corners of the board will have to be drilled to a larger size. A square box can be easily fabricated from sheet copper, brass, tin, or double sided circuit board. All four modules can be mounted in a box with the inside dimensions of four by six by two inches high. The boards are soldered in place by the ground foil. At least 1/4 inch clearance between the bottom of the boards and the mounting surface is recommended.

FILTER INSTALLATION

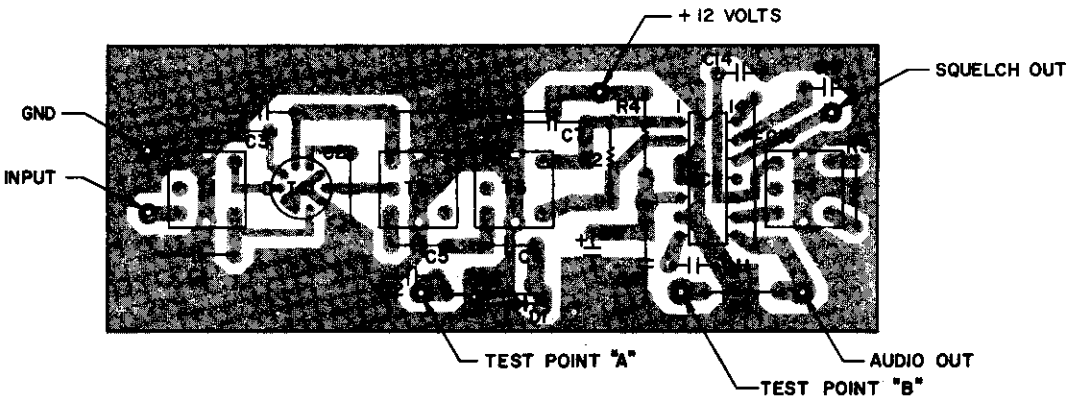
The IF 10.7F is normally supplied with a single (2 pole) filter. Install as shown by the solid outline in the print above. C-1 is not used.

If the 4 pole filter option is chosen, two filters must be installed as shown by the dotted outlines in the print above. C-1 is installed as shown.

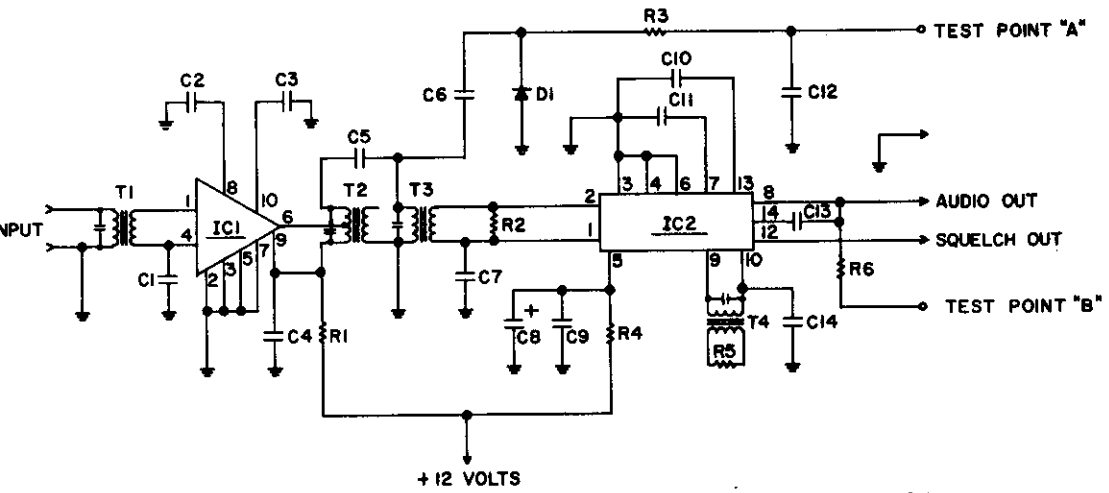
FM-455A

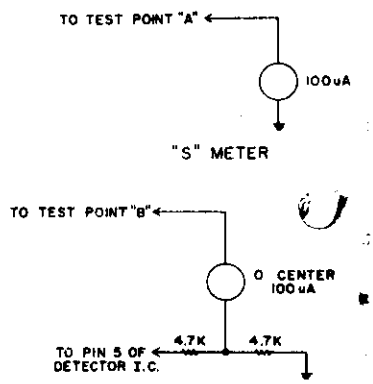
(Kit 7010330)
(Wired 7010331)

R1	1K	(2020230)	C1	.1	(2010440)
R2	560	(2020210)	C2	.1	(2010440)
R3	10K	(2020330)	C3	.1	(2010440)
R4	100	(2020100)	C4	.1	(2010440)
R5	1K	(2020230)	C5	10pf	(2010070)
R6	4.7K	(2020290)	C6	100pf	(2010250)
			C7	.1	(2010440)
T1-T4	455KHz IF Coil (yellow)	(2030130)	C8	100MFD at 16V	(2010540)
			C9	.1	(2010440)
D1	IN 34 or IN60	(1010010)	C10	.001	(2010370)
			C11	.022	(2010430)
IC1	MC1550G	(1050040)	C12	.022	(2010430)
IC2	LM3065	(1050090)	C13	.001 Mylar	(2010360)
			C14	68pf	(2010210)
7	Keystone Pins	(4060130)			
1	PC Board	(4040060)			
1	Instruction Sheet	(5010406)			



COMPONET VIEW
F.M.-455A





F.M.-455A

ASSEMBLY

It is easier to install the IC's first. The leads of the MC-1550G may be cut to different lengths to make installation easier. Be sure the metal tab is towards the input connections. Pin one of the detector IC mounts towards the twelve volt connection. The shield pins on the IF transformers should be bent before soldering. Make sure the negative lead of the electrolytic goes to ground.

TUNING

The FM-455 board can be tuned by applying a 455 Khz signal to the input and adjusting for maximum output at the audio output connection. The input signal should be kept below the limiting point. T1, T2, T3, are adjusted for maximum signal. T4 should be adjusted so the voltage on Pin 8 is exactly 1/2 the voltage on Pin 5. This voltage is usually about 5 volts and varies about this value as the input frequency is changed. A discriminator meter may be connected to test point B if the other end of the meter is connected to a 5 volt reference (see circuit description).

FM-455 A

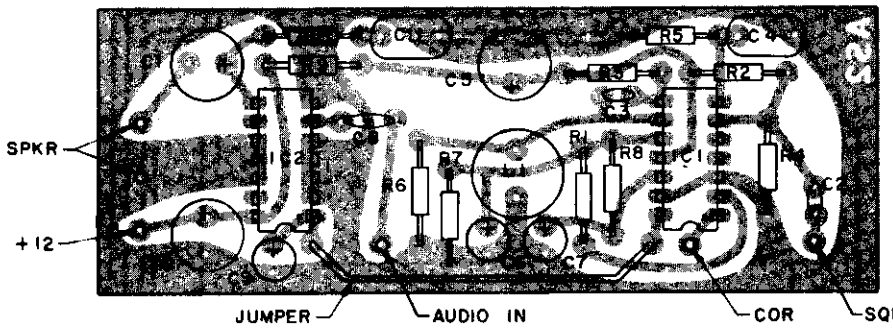
A 455 khz IF amplifier, limiter, and FM detector on one board using two IC's. The MC-1550G IF amplifier has over 30 db gain at 455 khz. The MC-1358 limiter and detector IC, has a built in zener regulator and voltage controlled audio amplifier. The board will start to limit at 20 microvolts input. The audio output is over 1 volt p-p across a ten kilohm load for a five khz deviation signal. The board will operate down to nine volts without degrading it's performance. The input is high impedance and should be connected to the 10p condenser in the IF-10,7. A low impedance input may be connected to the tap on T1.

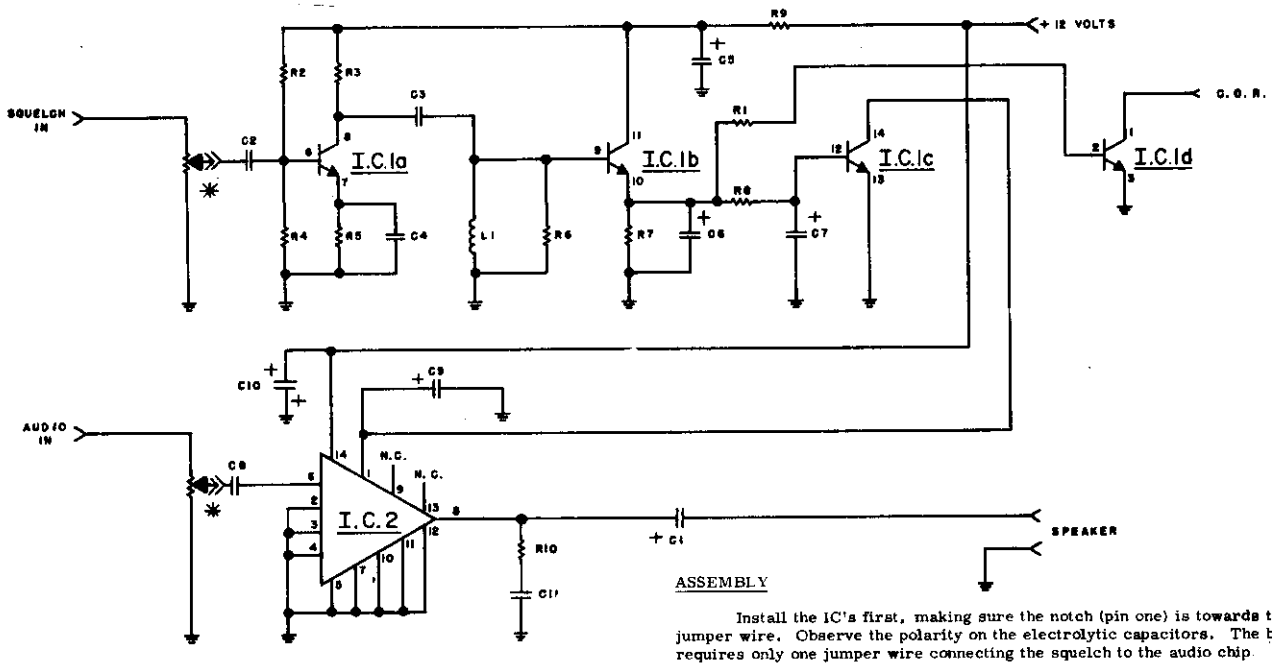
Pin 8 of the detector IC is the output of the quadature detector. This is similar to the discriminator output of tube type receivers. A discriminator meter may be connected to pin 8 through a resistor if the other side of the meter is connected to a 5 volt reference. This reference may be obtained by two resistors connected in series from pin 5 to ground. Connect the meter to the junction of the two resistors. The resistors should be closely matched and about 3 to 5 K Ohm. Pin 5 of the detector chip is regulated internally to 10 volts. The series resistor should be between 2 and 10 K ohm. This is selected for full scale reading or calibrating of the discriminator meter. A standard meter may be used instead of a zero center meter by replacing one of the series resistors with a pot and adjusting it for a center reading (50 ua).

AS-2

(Kit 7010360)
(Wired 7010361)

C1	100MFD at 16V (2010540)	R1	8.2K (2020320)	L1	82uh choke (2040060)
C2	.005 mylar (2010380)	R2	22K (2020360)	IC1	CA3086 (1050100)
C3	.005 mylar (2010380)	R3	4.7K (2020290)	IC2	LM380 (1050030)
C4	.1 mylar (2010450)	R4	4.7K (2020290)		
C5	100MFD at 16V (2010540)	R5	1K (2020230)	6	Keystone Pins (4060130)
C6	4.7MFD at 16V (2010490)	R6	10K (2020330)	PC Board	(4040071)
C7	4.7MFD at 16V (2010490)	R7	4.7K (2020290)	Instructions	(5010409)
C8	.02 mylar (2010431)	R8	8.2K (2020320)		
C9	4.7MFD at 16V (2010490)	R9	47 (2020080)		Squelch and volume controls
C10	100MFD at 16V (2010540)	R10	10 (2020030)		(not supplied) should be 10K
C11	.1 mylar (2010450)				





✱ NOT ON BOARD

AS-2

A two watt audio amplifier and squelch circuit on a single board. The LM-380 IC will deliver over two watts of audio onto a four to eight ohm speaker. The voltage gain is fixed to fifty.

The CA-3086 squelch IC contains five NPN transistors. They are used as a noise amplifier, detector, DC amplifier, and COR output. The high frequency noise is surpressed when a signal is received, causing the dc amplifier output to rise, switching on the audio IC.

INTERCONNECTIONS

The four boards can be connected together to form a complete receiver with only ten connections plus the ground. The twelve volts is connected to all four boards. The IF-10.7 has internal jumpers so it is not necessary to connect the two b plus connections. Too long of a cable will detune the IF coil, so six inches should be maximum length.

The end of C10 on the IF-10.7 is connected to the high end of T-1 on the FM-455 IF strip. This lead can be a piece of hook up wire if it isn't more than two inches long. A shielded cable can be used if it isn't more than six inches long.

The three connections between the AS-1 and FM-455 boards are power, ground, audio, and squelch noise. The latter two have audio voltage and should be shielded if longer than a couple of inches.

ASSEMBLY

Install the IC's first, making sure the notch (pin one) is towards the jumper wire. Observe the polarity on the electrolytic capacitors. The board requires only one jumper wire connecting the squelch to the audio chip.

POWER

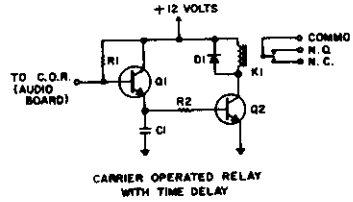
The receiver is designed to operate from a 12 volt DC negative ground source. The low current drain makes battery operation practical. A simple 12 volt supply at about 200 Ma. will operate the receiver. The output should be well filtered. If the power supply is located away from the receiver, a .1 MFD capacitor should be connected from the 12 volt line to ground on the audio board.

If the receiver is used mobile, a LC filter network should be used to filter the 12 volt line. This will eliminate alternater whine and ignition static. A 2 to 4 henry choke with at least a 100 MFD capacitor is recommended.

COR

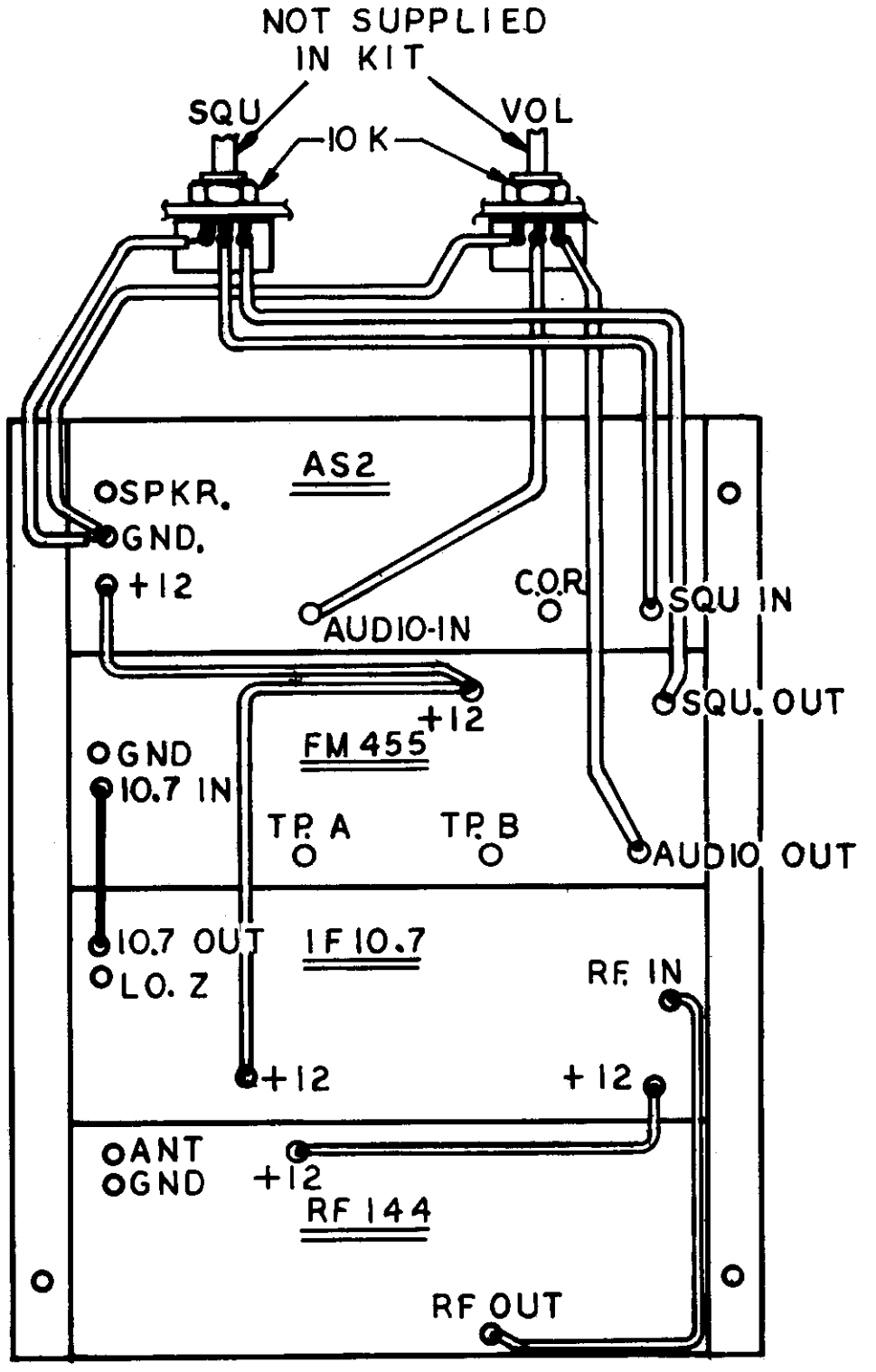
The COR pins provide a low impedance to ground when the receiver is squelched. Do not apply any voltage directly to the COR terminal.

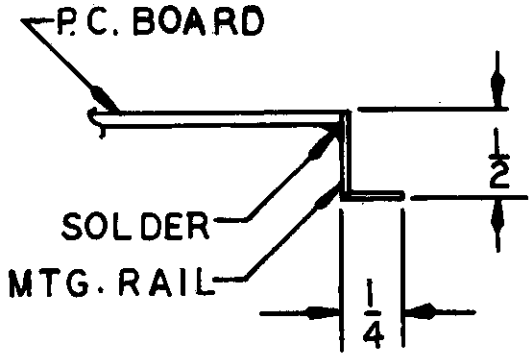
C1	100MFD
R1	22K
R2	1-5K
Q1	SK 3020
Q2	SK 3024
RL	12 VDC RELAY



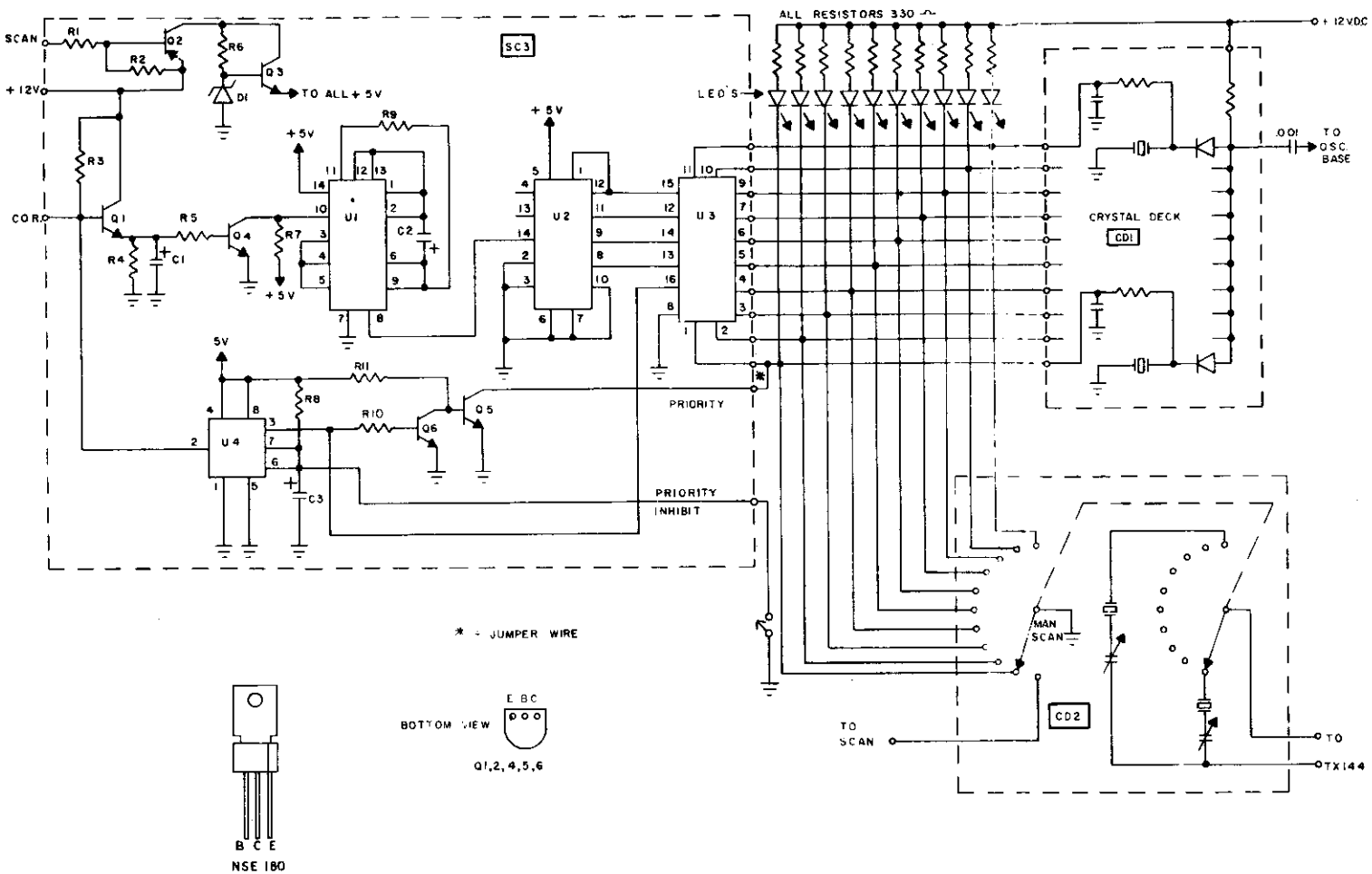
CARRIER OPERATED RELAY WITH TIME DELAY

TYPICAL RECEIVER HOOKUP





10 CHANNEL SCANNER



Typical scanner interface with transceiver using our SC-2, CD-1, CD-2 and TX-144 modules.

RECEIVER ALIGNMENT

Equipment required:

(a) Stable R.F. Signal Generator*
(b) V.T.V.M. or 20,000 ohms per volt V.O.M.
(c) Insulated flat (screwdriver) alignment tool

Step 1

Install and set volume control to about mid range. Install and set squelch control full counterclockwise. Connect receiver to a 8-16 ohm speaker and a twelve volt negative ground source. Some background noise should now be heard in the speaker.

Step 2

Insert a receive crystal (Y1) into the socket on the RF board. On the RF50 or RF432, refer to their individual sheets. The RF144 of RF220 tune as follows: The oscillator is tuned first by connecting a voltmeter across R-16 (negative lead to ground, positive lead to top of R-16) and adjusting L-5 for maximum voltage (3-6 volts). Remove and reapply power to make sure the oscillator will start each time. If the oscillator does not start each time, re-adjust L-5 slightly off peak.

At this point, the receiver should be able to detect strong signals (in the order of 100 microvolts). If no alignment equipment is available, reasonably good results can be obtained by using an on the air signal for alignment. Use the weakest possible signal and adjust all trimmers and IF coils for maximum voltage on test point "A".

Step 3

Connect the VTVM to test point "A" and ground. Set an RF signal generator to the channel frequency and connect the output to the receiver antenna terminals. Adjust all of the IF transformers except the discriminator (T-4 on FM455) for maximum reading on the meter. Compensate for the increase in IF stage gain by decreasing the input level from the signal generator. The voltage must be kept below the 3-4 volt limiting range. If this condition is not maintained, the IF system will saturate and limiting will occur, resulting in improper alignment of the transformers.

* An on-the-air signal can be used if necessary.

Adjust all trimmer coils on the RF board for maximum voltage. Again, keep the generator below the 3-4 volt limiting range.

Rock the generator frequency back and forth until maximum voltage is indicated at test point "A". This will insure that the generator is centered in the band pass of the filter. Readjust all of the IF transformers for maximum output.

Repeat step 3 three or four times until no further increase in gain (output) can be achieved.

Step 4

The descriminator transformer (T-4 on the FM455 board) may be adjusted by several methods. The most accurate is to connect an oscilliscope to test point "B" and adjust T-4 for symmetrical noise above and below the base line. Acceptable results can be obtained by adjusting T-4 for a noise peak on a blank channel. The voltage at test point "B" should be about 5.5 volts ±10% with no signal. It should also measure 5.5 volts with a signal centered in the receivers band pass. Adjusting a signal generator across the bandpass will cause the voltage to vary about 1 volt each side of the 5.5 volt center.

Step 5

Set the signal generator to the receive frequency. Turn the output level of the generator to the OFF position. Adjust squelch control C.W. until receiver audio cuts off. This point generally is found at one half to three quarters of full C.W. rotation. With the receiver muted or squelched, increase the output level of the generator to the point where audio is switched back on. This point should be in the order of .3 microvolts or less.

Step 6

The frequency of the receiver local oscillator may be checked with a frequency counter. On the RX50, couple to L-5. On the RX144 and RX220, use a two turn link close couples to L-7. The counter should read the receive frequency minus 10.7 plus or minus 3 KHz. On the RX432, couple to L-6 (if a 500MHz counter is not available, couple to L-8 and multiply reading by 3).

The local oscillator frequency may be adjusted on the RF144, RF220 and RF432 with the variable capacitor across the crystal. This capacitor should be removed when using the multichannel crystal deck.

TROUBLE SHOOTING

NOTE:

AFTER EACH BOARD IS ASSEMBLED, A VISUAL INSPECTION OF SOLDER JOINTS AND MECHANICAL REGIDITY SHOULD BE MADE. BE ESPECIALLY CAREFUL OF EXCESSIVE SOLDER AT CONNECTIONS. IT IS VERY EASY TO HAVE A SOLDER SPLASH ACROSS ONE OR MORE ISLANDS ON PRINTED CIRCUIT BOARD.

AS-1 Audio Squelch Board

Receiver Dead

Open squelch control fully C.C.W. and :

A. Check to see if audio amplifier is working by placing finger or audio signal to high side of volume control. Check voltage at Pin 8 of LM-380 (IC-2) with squelch set fully C.C.W. This voltage should be close to half of supply voltage.

B. Neither of the above indicates a bad audio or squelch IC. Removal of the jumper on the board will eliminate the squelch IC from the circuit. If the above still does not check out, the audio IC is defective.

C. If the above checks out then the detector I.C. may be defective. With detector stage and audio squelch circuitry operative a background hiss should be audible.

D. Squelch setting should be about half C.W. with properly aligned receiver with no R.F. signal applied. In the event the control only functions at extreme end C.W. or not at all then receivers I.F. system is improperly aligned or a stage or stages is low on over all gain. The squelch system functions on noise and is dependent on over all gain of the receiver I.F. system.

FM-455 455 IF and Detector Board

The audio board checks out but receiver is dead

A. An open winding on any of the IF transformers may cause loss of audio.

B. If the receiver is dead and a audio signal injected at Pin 8 of the detector IC is heard in the speaker the detector chip is defective.

FM-455 Continued

Low noise in speaker, squelch inoperative, weak or no reception

A. Check the IF Cans for opens or misalignment.

B. The IF amplifier may be checked by injecting a 455 Khz signal through a .01 mfd condenser to Pin 1 and Pin 6. There should be a noticeable increase in signal to noise ratio on Pin 1 compared to Pin 6.

IF-10.7 First IF and Second Converter Board

Weak or no reception, squelch and background noise normal

A. Check IF cans for open or misalignment.

B. Normal operation of the second oscillator is indicated by a nominal 3 volts RF at Pin 2 of IC-2.

C. The IF amplifier may be checked by injecting a 10.7 Mhz signal through a .01 mfd condenser to Pin 1 and Pin 6. There should be a noticeable increase in signal to noise ratio on Pin 1 compared to Pin 6.

No reception, squelch and background noise normal

A. Check local oscillator. This may be done by coupling a frequency counter to the oscillator coil or by checking for RF voltage on the collector of the oscillator with a RF probe or wide band scope. On the RF-144, 220, and 432, a correct tuning indication on the multiplier stage emitter indicates proper oscillator output.

B. Check for proper installation of the transistors.

C. Check the DC voltages on the transistor. Readings should run within plus or minus 10% of voltage table.

VOLTAGE CHART

RF-50

Q1 (2N5486)	(S) 1.4	(G) 0	(D) 12	
Q2 (2N5222)	(E) 4.6	(B) 4	(C) 12	
Q3 (3N204)	(S) .4	(G1) 0	(G2) 1.3	(D) 12

RF-144

Q1 (2N304)	(S) .45	(G1) 0	(G2) 2.4	(D) 12
Q2 (2N304	(S) .45	(G1) 0	(G2) .4	(D) 12
Q3 (2N5222)	(E) 4.0	(B) -.1	(C) 12	
Q4 (2N5222)	(E) 3.5	(B) 4	(C) 12	

RF-432

Q1 (J310)	(S) 1.4	(G) 0	(D) 12
Q2 (J310)	(S) 1.4	(G) 0	(D) 12
Q3 (J310)	(S) 3.3	(G) 0	(D) 12
Q4 (2N3486)	(E) 7.4	(B) 3.3	(C) 12
Q5 (2N3486)	(E) .4-.5	(B) -.15	(C) 12

IF-10.7 MHz Board

IC-1	PINS	VOLTS	IC-2	PINS	VOLTS
MC-1550G	1	.70	LM-3053	1	8.30
	2	0	CA-3028A	2	3.80
	3	0		3	0
	4	.70		4	4.40
	5	0		5	8.20
	6	9.60		6	12
	7	0		7	12
	8	4.80		8	12
	9	10			
	10	4.10			

FM-455A Board

IC-1 MC-1550G	PINS	VOLTS	IC-2 MC-1358 LM-3065	PINS	VOLTS
	1	.70		1	2
	2	0		2	2
	3	0		3	0
	4	.70		4	0
	5	0		5	11
	6	10		6	0
	7	0		7	6.1
	8	4.90		8	5.5
	9	10		9	3.4
	10	4.5		10	3.4
				11	0
				12	5.0
				13	5.8
				14	1.5

AS-1 Board

IC-1	PINS	VOLTS		IC-2 LM-380	PINS	VOLTS	
	1	0			1	.1	6.5*
LM-3086	2	.64			2	0	
	3	0			3	0	
	4	0			4	0	
	5	0			5	0	
	6	2.30			6	0	
	7	1.60			7	0	
	8	6.0			8	1.7	6.30*
	9	0			9	0	
	10	2-3	0*		10	0	
	11	12.60			11	0	
	12	.70	0*		12	0	
	13	0			13	0	
	14	.10	6.5V*		14	12.60	

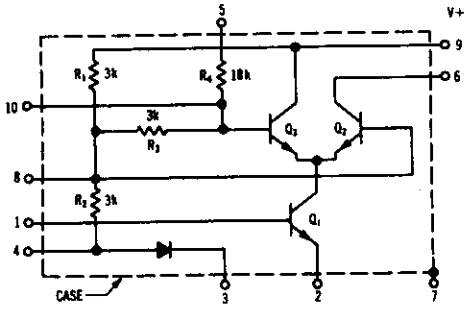
* DENOTES UNSQUELCHED READING

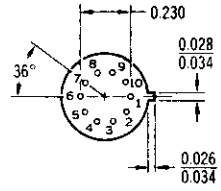
NOTE:

I All readings taken with 20,000 ohm per volt meter.
II Voltages may vary by Plus or Minus 10%.
III Source voltage regulated 12.6V D.C.
IV Receiver squelched no R.F. signal applied.

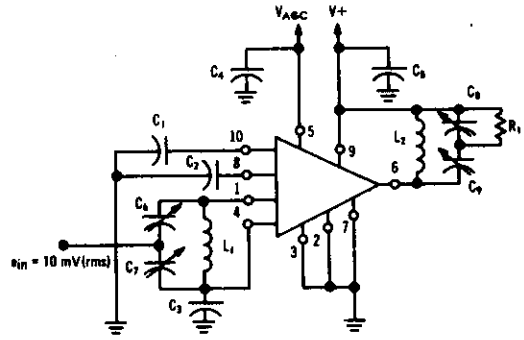
MC-1550G

CIRCUIT SCHEMATIC





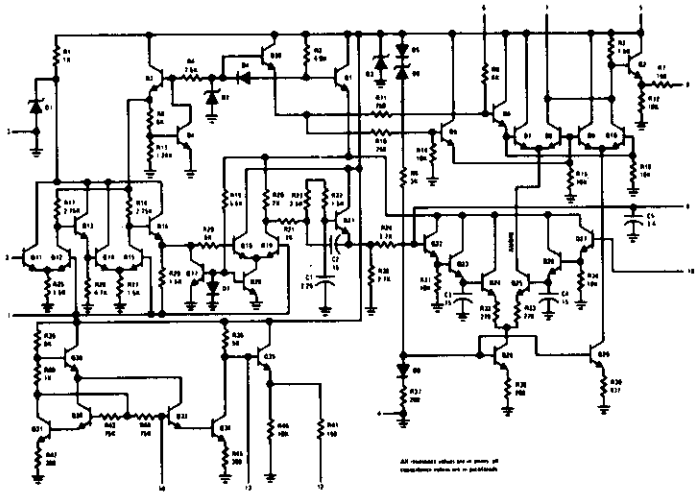
PIN 7 CONNECTED TO CASE



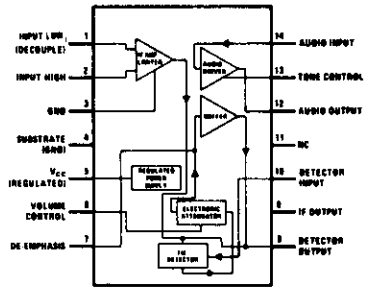
BOTTOM VIEW

MC-1358P---CA-3065---LM3065N

schematic and connection diagrams



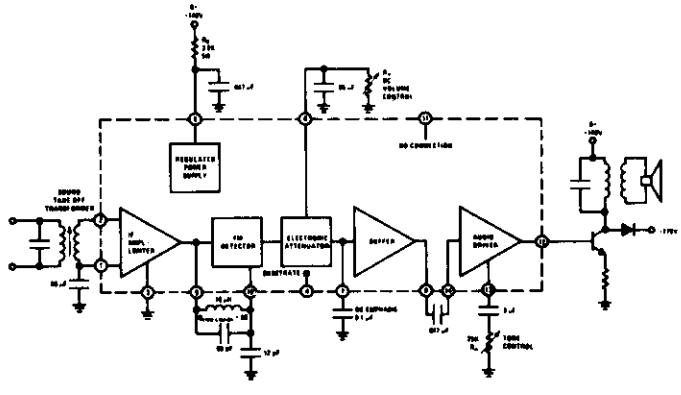
Dual-In-Line Package

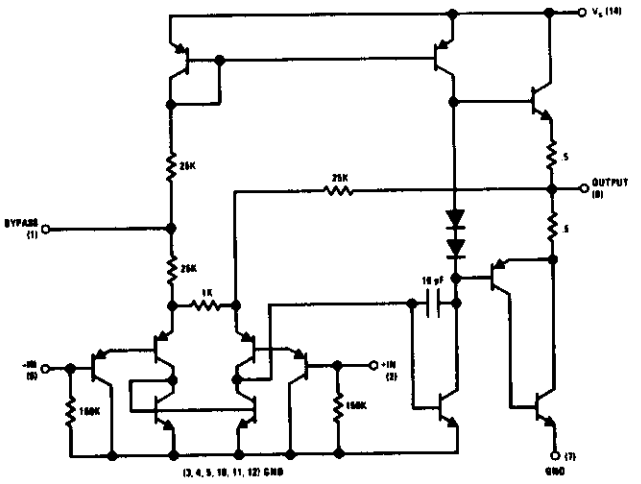


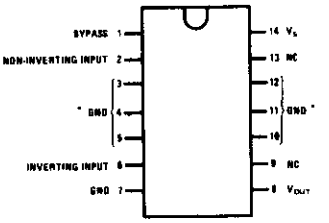
TOP VIEW

MC-1358P
CA-3065
LM-3065N

block diagram

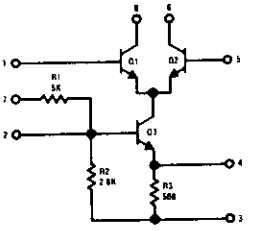




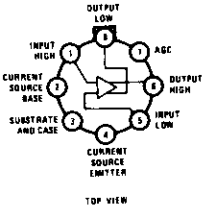


TOP

CA-3028A----LM-3053H



Metal Can Package



CA-3028A
LM-3053H

NOTE: The pin numbering is different then the MC-1550G.

CA-3086---CA-3046