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**BR 8258**

**OUTFIT AV(2)**

**VHF/DF RECEIVER FOR SMALL CRAFT**

**(REGENCY POLARIS NC 7100)**

By Command of the Defence Council

DECEMBER 1983

*Alvin Whitmore.*

MINISTRY OF DEFENCE  
SEA SYSTEMS CONTROLLERATE-DEPUTY CONTROLLER WARSHIP EQUIPMENT

(D/WE/DG5W/339/8258/82)

# AMENDMENT RECORD

When an amendment to this handbook is incorporated the brief details required below are to be filled in. The modification number will be shown on the Amendment Instruction page when the amendment is caused by an equipment modification.

Amdt No	Date Inserted	Initials	Modification No
1	27.1.88	JM	/
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### INTRODUCTION

The Regency Electronics NC 7100 commercial receiver has been introduced into naval service as Outfit AV(2) - VHF/DF Receiver for Small Craft.

The supporting Regency Electronics Handbook is promulgated under a DGSW(N) title page as BR 8258 which contains NC 7100 maintenance information (Section 2 of the original Regency Electronics Handbook) and "User Information" in the form of a pamphlet entitled "Owner's Manual".

In view of the ease of installation and comparative simplicity of the equipment there will be no additional support information for the following:

Installation  
Setting to Work  
Hat's  
SAT's

Note: An example Weapon Equipment Performance Record Sheet is included for use by CWTA.

### SPARE ITEMS ALLOCATED NATO STOCK NUMBERS

(as detailed in E List S2056 dated 7 March 1983)

<u>Description</u>	<u>Class Group</u>	<u>NSN</u>
Battery	0562	6135-99-949-6083
Adaptor	0568	5935-99-427-7536
Fuse, 2A	0584	5920-99-118-8211
Antenna, Dish Assembly (Part No 7114-5154-100)	0617	5820-99-758-1619
Antenna, Dipole Assembly (Part No 1203-3291-701)	0617	5820-99-758-1618
Loudspeaker, MA 230	0617	5820-99-758-1621
Kit Aerial Mounting, MA 221	0617	5985-99-758-9022
Pole & Cable Assembly, MA 222	0617	5985-99-759-4660
Power Supply, P 1405	0617	5820-99-758-2811
Receiver, NC 7100	0617	5825-01-149-7617
Plug	0625	5035-99-527-9393

## WEAPON EQUIPMENT PERFORMANCE RECORD SHEET

OUTFIT AV(2) (REGENCY POLARIS NC7100)

HMS .....

Reference BR 8258	Item No.	Check And/Or Record
BR 8258 Rear Section Page 1       Pages 7/8	1	<u>Power Supply</u> a. Check that 115 V 60 Hz is available to power supply unit. <input type="checkbox"/> b. Check that output from power supply unit to the receiver is 12 V DC nominal. <input type="checkbox"/>
	2	<u>Operation</u> a. Initial Settings (1) OFF/Vol SWITCH - Off (2) ON/OFF/Hold - Off (3) US/INT - INT (4) Memory Lock/Unlock - Unlock (5) Day/Night - Day (6) Priority/OFF/Ch16 - Off b. Initial Operation Checks (1) Check that on turning Off/Vol switch to 'on' a click is followed by a 'Beep' tone. <input type="checkbox"/> (2) Check operation of volume control and squelch control. <input type="checkbox"/> (3) Activate the direction finder by switching the ON/HOLD switch to 'on'. Check that after a short delay the 36 yellow LEDs begin circling clock-wise at approximately 2 rotations per second. <input type="checkbox"/> (4) Check the day/night switch by switching to 'night'. Check the channel display and 36 LEDs dim and program panel becomes illuminated. <input type="checkbox"/> (5) Enter Channel 77 into programme panel. Switch Priority/OFF/Ch16 switch to 'Priority'. Check that Channel 77 is displayed and is briefly interrupted once per second and replaced by 16. <input type="checkbox"/> (6) Switch Priority/OFF/Ch16 switch to 'Ch16'. Check that 16 is displayed constantly. <input type="checkbox"/>



Reference BR 8258	Item No.	Check And/Or Record
Page 9	3	<u>Manual Operation</u> Check that Channels 01-28 and 60-88 can be entered by the programme panel. <input type="checkbox"/> <u>NOTE:</u> A invalid channel entry will be displayed by flashing digits. <input type="checkbox"/>
Page 10	4	<u>Scan Mode</u> a. Press 'Fill' key on programme panel. <input type="checkbox"/> b. Press 'List' key. Check that all 55 channels are displayed in numerical order at the rate of 2 channels per second and that the yellow LED next to 'Scan' in the display winks for each channel change in the list. <input type="checkbox"/> c. Press 'Scan' check that unit scans all 55 channels and stops scanning on any working channels. <input type="checkbox"/> d. While receiver is scanning press 'Manual' key and check that scanning stops and channel number is displayed. <input type="checkbox"/>
Page 15/16	5	<u>Direction Finder</u> a. Switch ON/OFF/Hold switch to 'on'. b. Establish VHF comms with a working channel. With a long test transmission check that 36 LEDs stop circling and the indicated bearing is within $\pm 5^\circ$ . <input type="checkbox"/> c. Check that a 1200 Hz background tone is also present. <input type="checkbox"/> d. Check that after 2 seconds of end of test transmission the 36 LEDs begin circling again. <input type="checkbox"/>  Acceptance Authority                      Setting to Work Authority Signed ..... Signed ..... For ..... For ..... Date ..... Date .....

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**SECTION 2**

**Model NC7100**

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# **SERVICE MANUAL**

## **MODELS**

**NC7200**

**NC7100**

**MT7000**

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# NC7100

## SPECIFICATIONS

GENERAL	RECEIVER
Dimensions (LxWxH) ..... 11.1x11.2x3.6	Channels ..... 75
Weight ..... 11 lb. 6 oz.	Sensitivity (max.) 20 db
Temperature Range: °C ..... -20 to +50	Quieting ..... 35 $\mu$ V
Power ..... 13.6 VDC	12 db Sinad ..... 25 $\mu$ V
Standby ..... 1A	EIA
Stability ..... $\pm$ .001%	Selectivity ..... 70db
	Intermodulation ..... 70db
	Spurious & Image Rejection ..... 70db
	Audio Output ..... 5W @ 10% distortion 3.2 ohm
	Modulation ..... $\pm$ 7.5 KHz Acceptance

## MARINE INSTALLATION

1. The NC7100 transceiver is designed for installation in any vessel that has a 12 VDC negative ground system. The red lead with the fuse holder must be connected to the positive terminal of the battery. The black lead should be connected to the negative terminal or to a metal part that is connected to the negative terminal of the battery. In the event that the battery is remotely located, it may be necessary to install additional wires.
2. Connect the speaker by inserting the plug into the jack on the rear panel marked "NORM SPKR". The "HAIL SPKR" jack is used to connect another speaker for hailer use.
3. Install the nine volt battery (included with the unit) by removing the battery cover and attaching the battery to the clip supplied. Place the battery in position and replace the cover.

## DF ANTENNA INSTALLATION

1. Attach the side and swivel mounting brackets to the vessel. (See Figure 1).
2. Install the eight (8) dipole elements in the sockets on the antenna assembly as indicated in Figure 1. Tighten securely.
3. Screw the base of the mast onto the swivel mounting bracket. Tighten securely.
4. Slip the antenna mounting base over the top of the mast. Make sure the clamp is in place around the lower portion.
5. Locate the dipole identified by a black dot on its mounting boom.
6. Rotate the antenna assembly on the mast until the dipole with the black dot is in a position to point towards the bow of the vessel when the antenna is raised to its final position. Tighten the clamp until it is snug but not tight.
7. Connect the Direction Finder control cable, and the antenna coax cable to the antenna assembly.
8. Raise the antenna to its final position and check to see that the black dot is pointing towards the bow.
9. Lower the antenna, make any necessary rotation adjustments, and tighten the clamp securely.
10. Raise the antenna to its final position and secure the mast in the side mounting bracket.
11. Use of the eyebolts supplied for guy wire attachment is recommended for antennas that will be experiencing high velocity wind.
12. Route the control cable, and antenna cable as required to the unit. Insert the control cable plug into the DF CONT socket. Connect the antenna lead to the DF ANT connector.

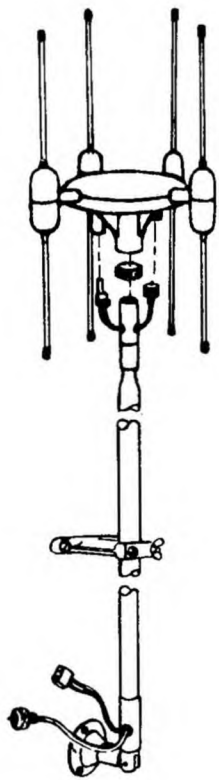


FIG 1

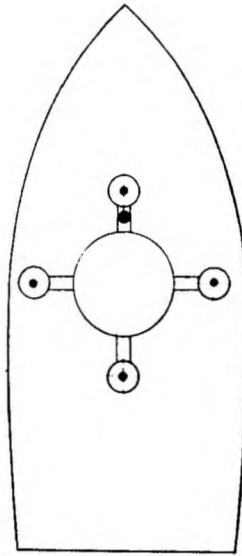


FIG 2

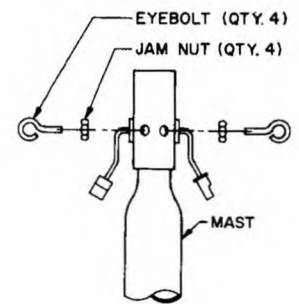


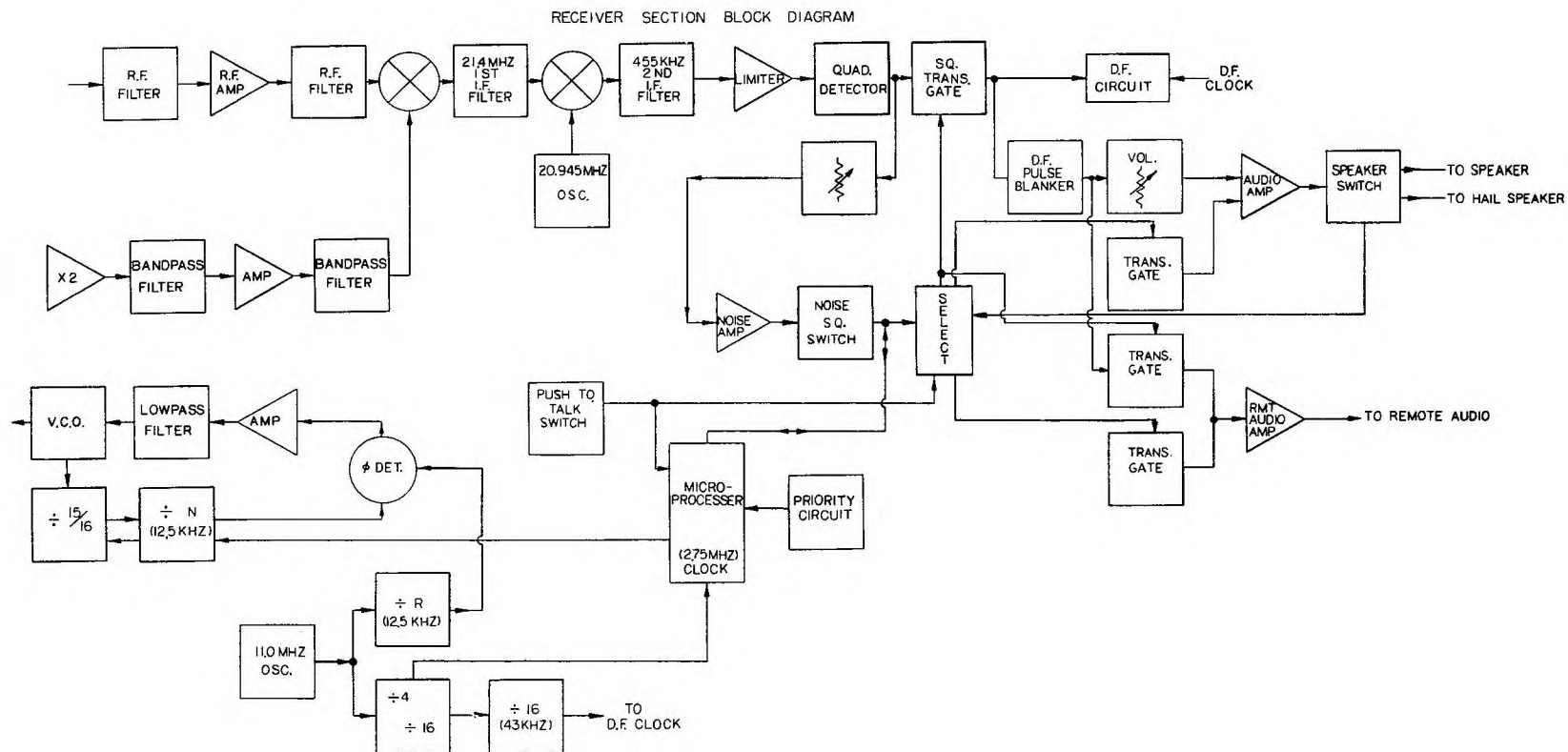
FIG 3



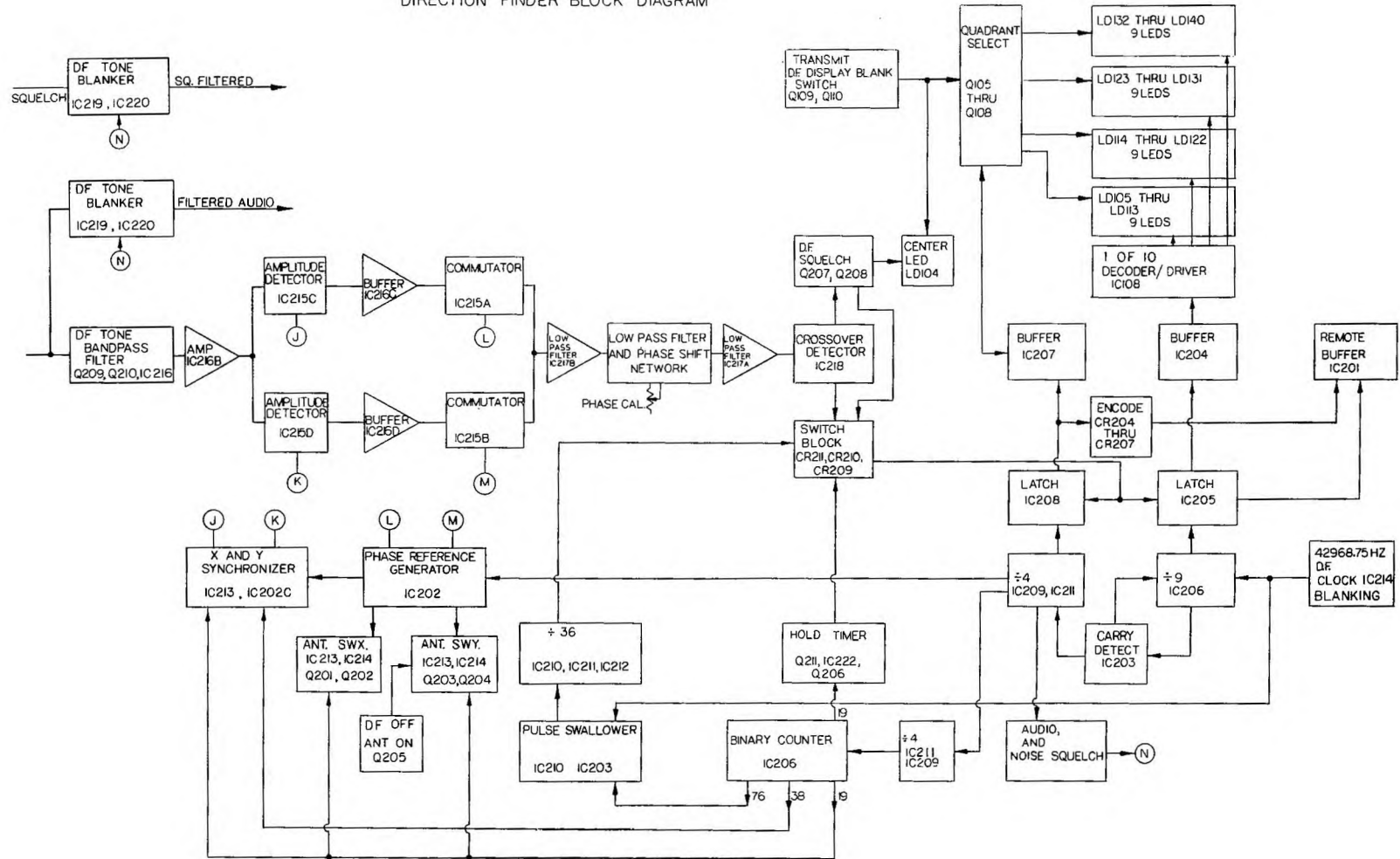
**INSTRUCTIONS FOR**  
**OVERHEAD/BULKHEAD MOUNTING**  
**FOR POLARIS NC7200, NC7100, AND MT7000 MODELS**

1. Remove mounting bracket, tray assembly.
2. Remove mounting pin from mounting bracket, tray assembly.
3. Remove ear from mounting bracket tray assembly by removing three rivets. This is to clear battery cover.
4. Install 1 round rubber foot in each pocket adjacent to mounting bracket, tray assembly.
5. With radio upside down and nose away, remove six 1/4" screws from case bottom. The bottom can then be removed by lifting at the rear.
6. Remove 1/4" screws from case top mounting brackets (two per side). With radio right side up and nose away, remove case top. Grasp case top at rear. Flex sides outward and lift slightly at rear. Maintain grasp at left rear, grasp right front and flex outward to clear microphone connector and lift off.
7. Remove side mounting assembly brackets (2 1/4" screws per bracket assembly).
8. Remove 2 screws holding microphone connector and after noting position of wire dress, drape inside chassis.
9. Remove 1 screw each side (2 total) to loosen bezel (white).
10. Work bezel off rear of radio.
11. Flip bezel top to bottom and reverse procedure.

NOTE: Using this procedure, front panel (black) is not removed from radio.



DIRECTION FINDER BLOCK DIAGRAM



## SYNTHESIZER ALIGNMENT

### EQUIPMENT REQUIRED

VTVM  
Audio Signal Generator  
Deviation meter  
50 ohm load termination

1. Connect the DC probe of the VTVM to pin 6 of IC302, common lead to chassis.
2. Key in channel 60 on the control panel keyboard.
3. Adjust L301 for a VTVM reading of 4.75 volts,  $\pm .1$  volt.
4. Connect the DC probe of the VTVM to TP301.
5. Adjust L302 for maximum reading on VTVM.
6. Adjust L309 for minimum reading, (dip).
7. Adjust L303 for maximum reading.

Repeat steps 5, 6 and 7 until no further improvement can be obtained.

## RECEIVER ALIGNMENT

### EQUIPMENT REQUIRED

VTVM  
FM Signal generator

Connect external speaker to speaker output.

Key in channel 60, (160.625 MHZ) on the control panel keyboard.

Connect the DC probe to VTVM to TP401, common to chassis.

1. Adjust L405 for maximum DC voltage.
2. Turn core of L303, (on synthesizer board), one half, ( $\frac{1}{2}$ ), turn clockwise into the coil.
3. Key in channel 6, (156.300 MHZ) on the control panel keyboard.
4. Set the signal generator to 156.300 MHZ 1KHZ tone, 3KHZ deviation.
5. Connect AC VTVM across speaker.
6. Adjust L407 for maximum audio.
7. With no input to the receiver and open squelch, adjust the volume control to obtain 1.0 volt of noise on the VTVM.

8. Connect the signal generator (no modulation) to the receiver input and adjust the generator output to obtain a reading of 0.2 volts.
9. Adjust the cores of L401, L402 and L403 in that order for minimum reading on VTVM. Adjust generator output to maintain 0.2 volt reading.
10. Key in WX2 on the control panel keyboard.
11. Set the signal generator to 162.400 and adjust the generator output for 0.2 volt reading.
12. Adjust the cores of L404 and L406 in that order for minimum reading. Adjust signal generator output to maintain 0.2 volt reading.
13. Key in channel 6 on the control panel keyboard.
14. Set the signal generator to 156.300 and adjust the generator output to obtain 0.2 volt reading.
15. Readjust L401, L402, and L403 for minimum reading. Adjust signal generator output to maintain 0.2 volt reading.
16. Repeat steps 3 thru 16 until no further improvement can be made.

## DF ALIGNMENT

### EQUIPMENT REQUIRED

#### VTVM

1. Temporarily connect a jumper between TP201 and TP202 on direction finder board.
2. Connect AC probe to VTVM to pin 1 of IC216, common to chassis.
3. Adjust R251, for maximum voltage reading on VTVM.
4. The bearing indicator light at 135° should be lighted.
5. Check to see that the indicator light moves one light each way from 135° as R251 is turned through its range. Remove jumper.

TO SYNTHESIZER BOARD

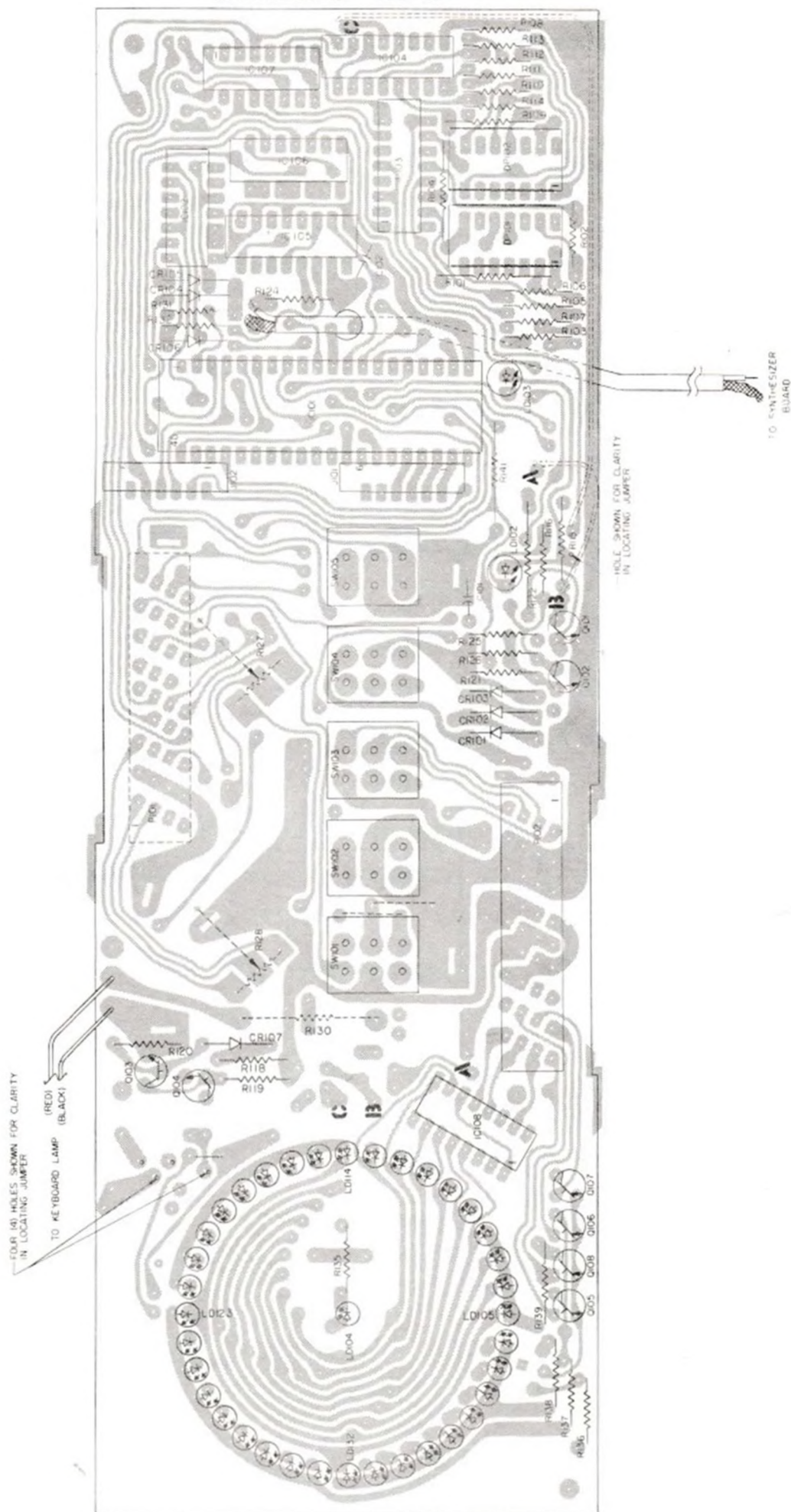
**HOLE SHOWN FOR CLARITY  
IN LOCATING JUMPER**

NOTE: WIDE NO. 26 FROM P101 AND P102 IS INDEXED TO PIN NO. 2 OF J201 AND J202

TO KEYBOARD LAMP

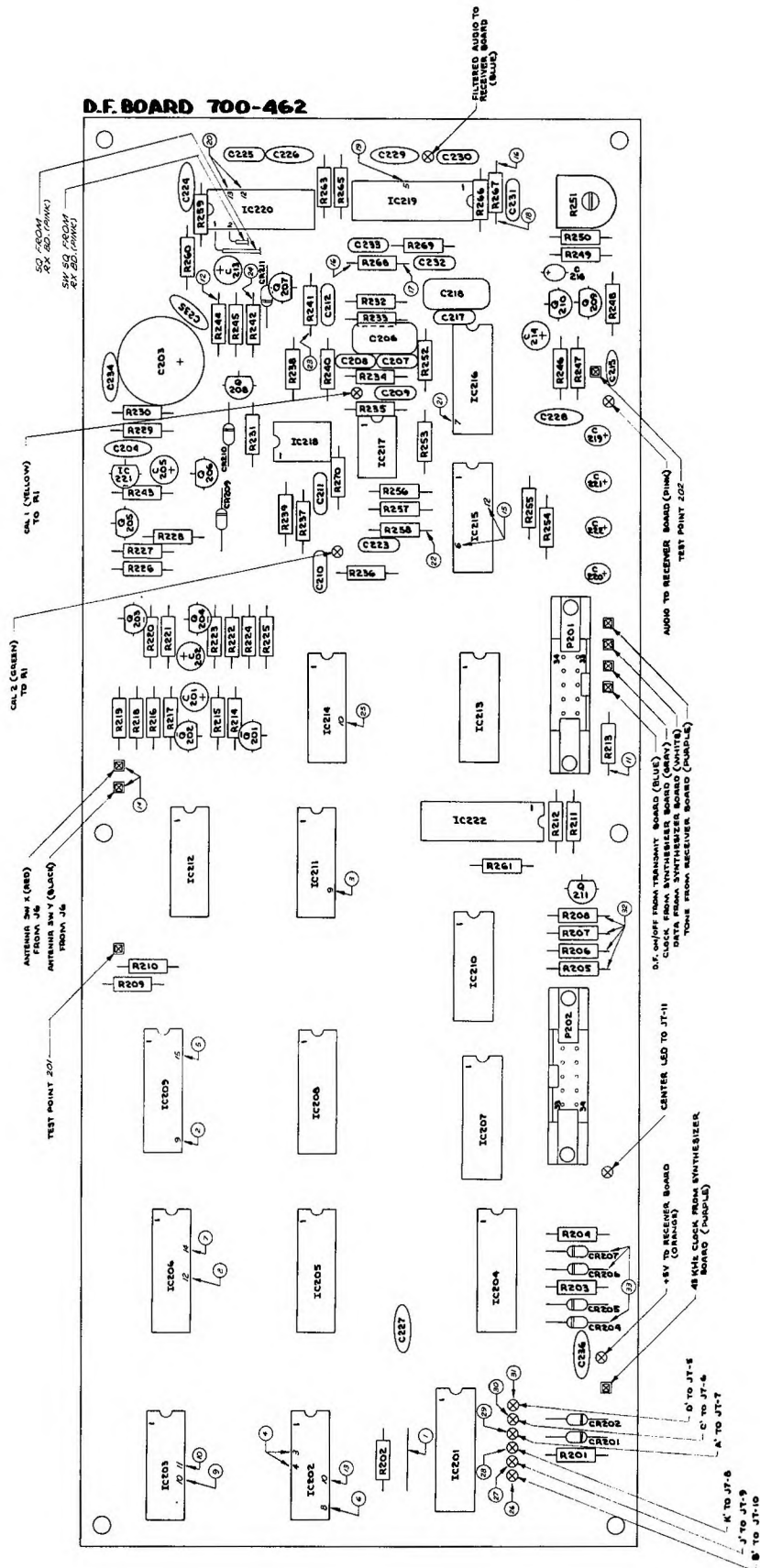
- FOUR (4) HOLES SHOWN FOR CLARITY IN LOCATING JUMPER

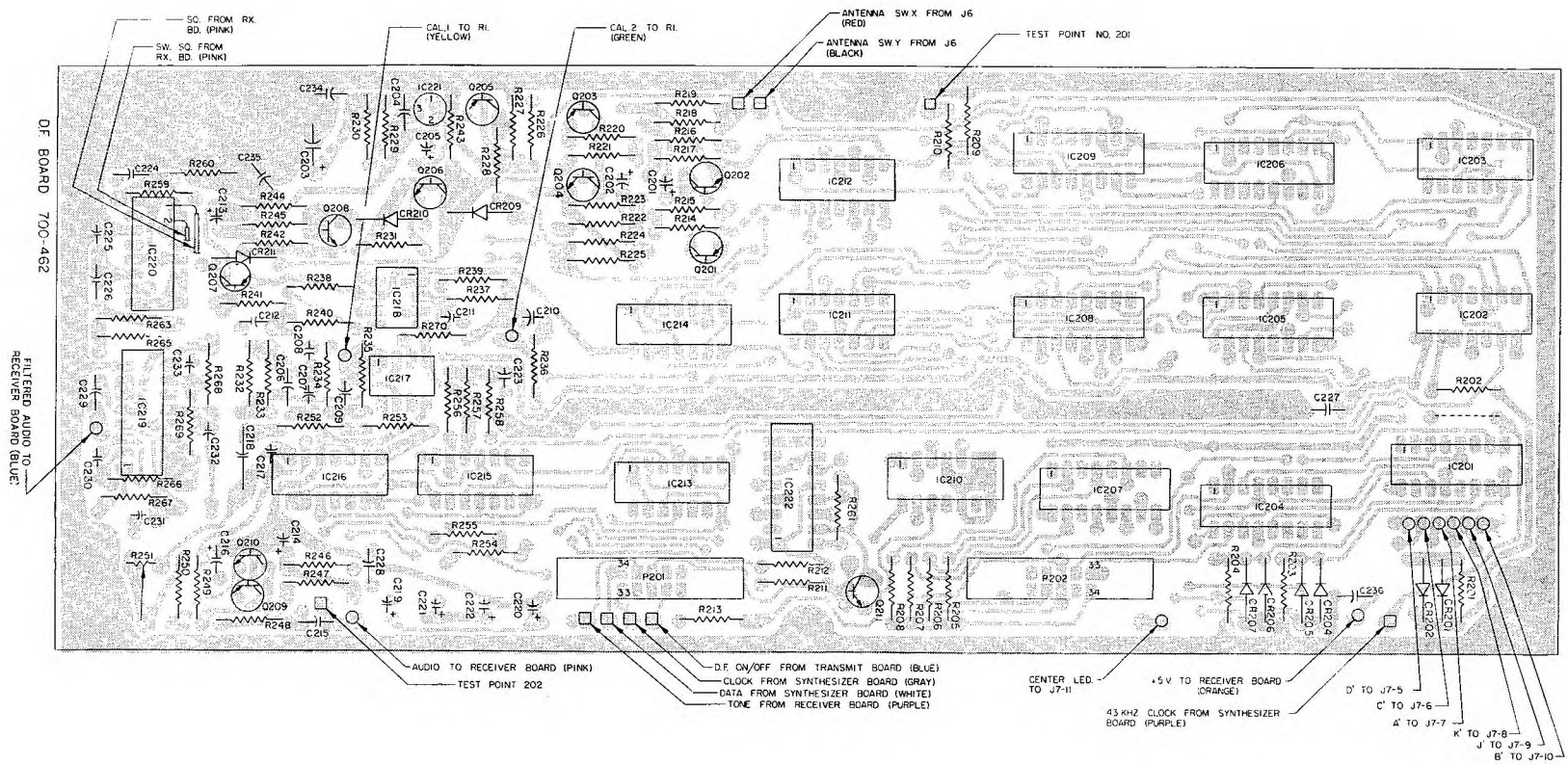


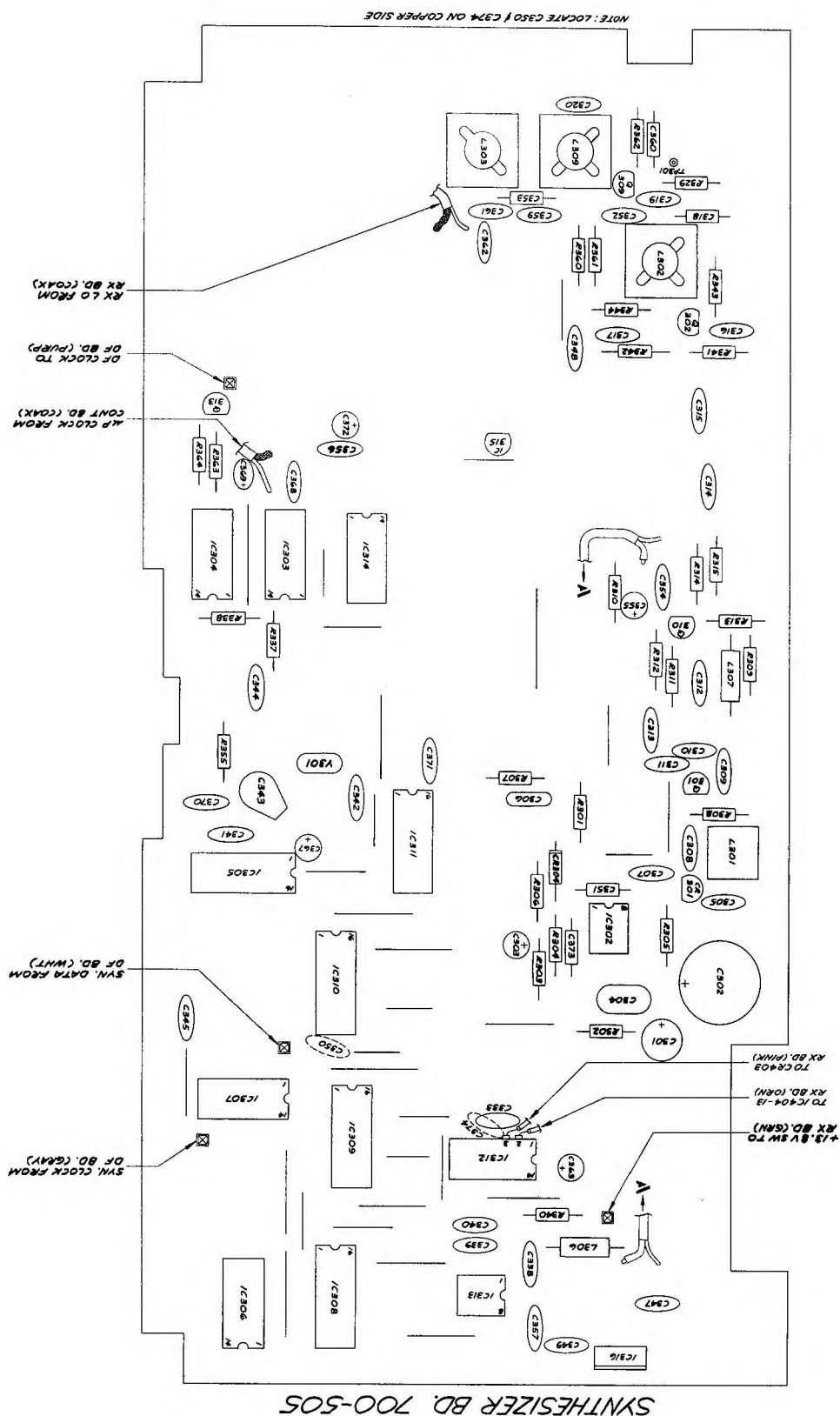


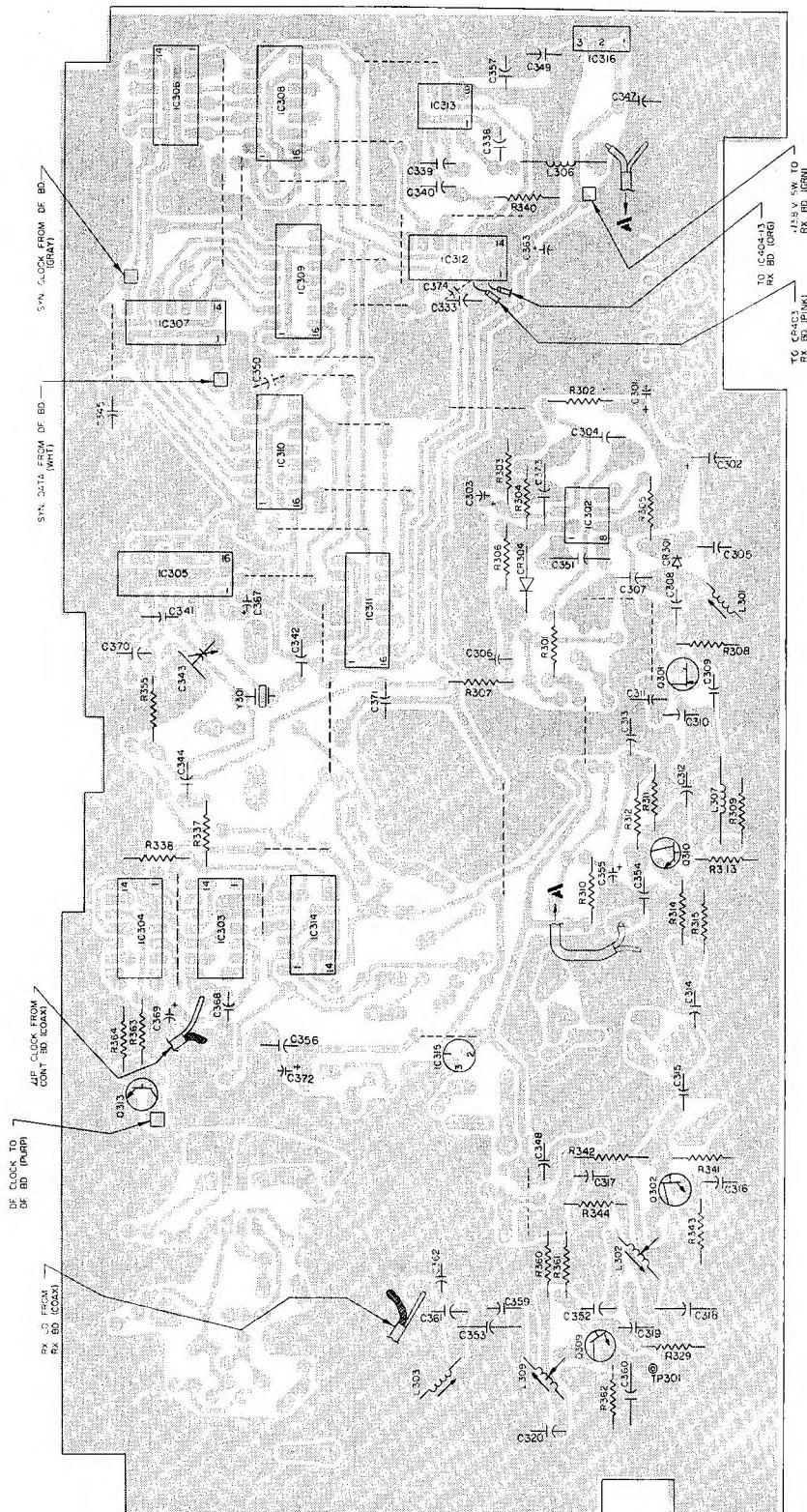


# D.F. BOARD 700-462



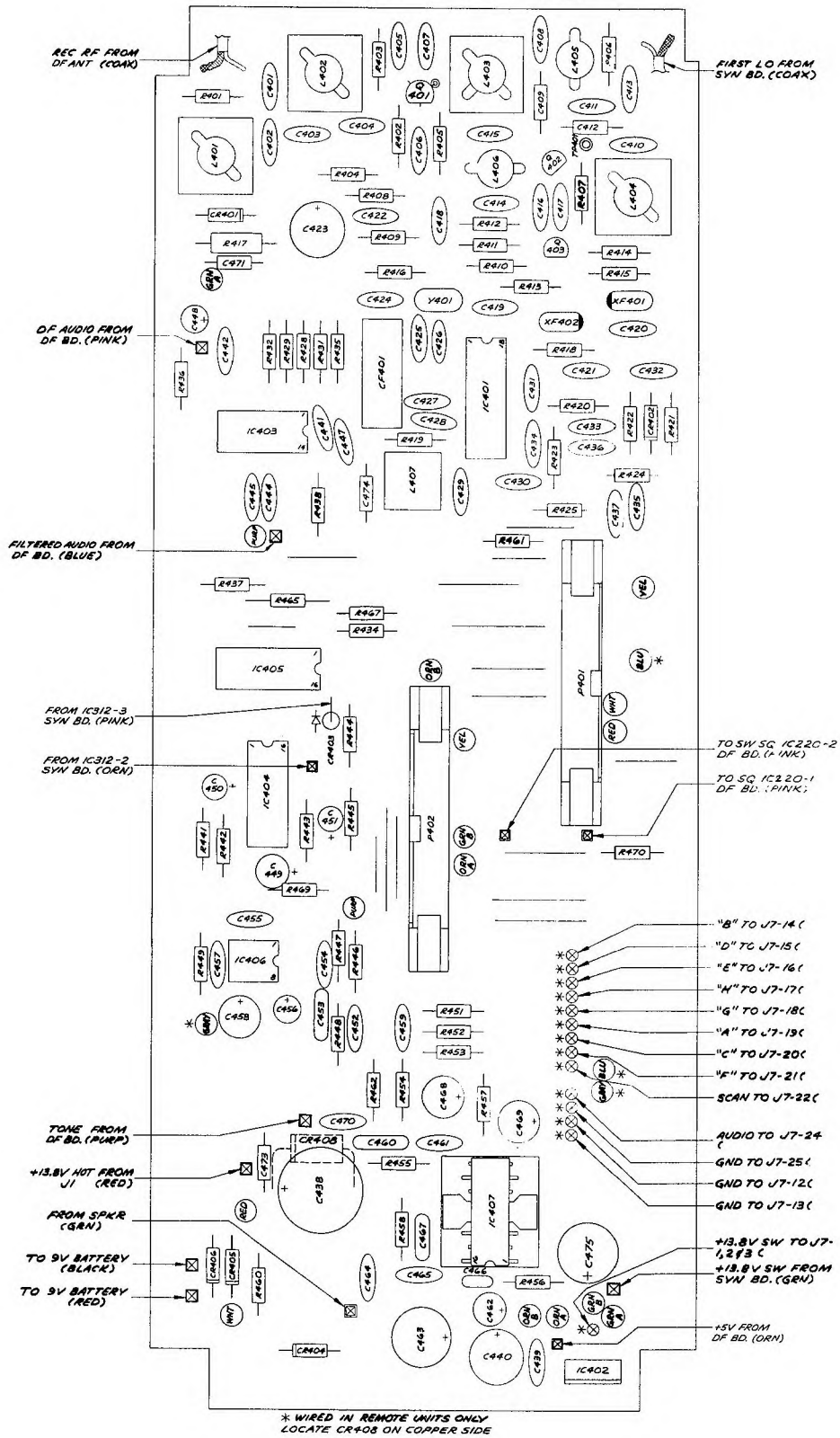






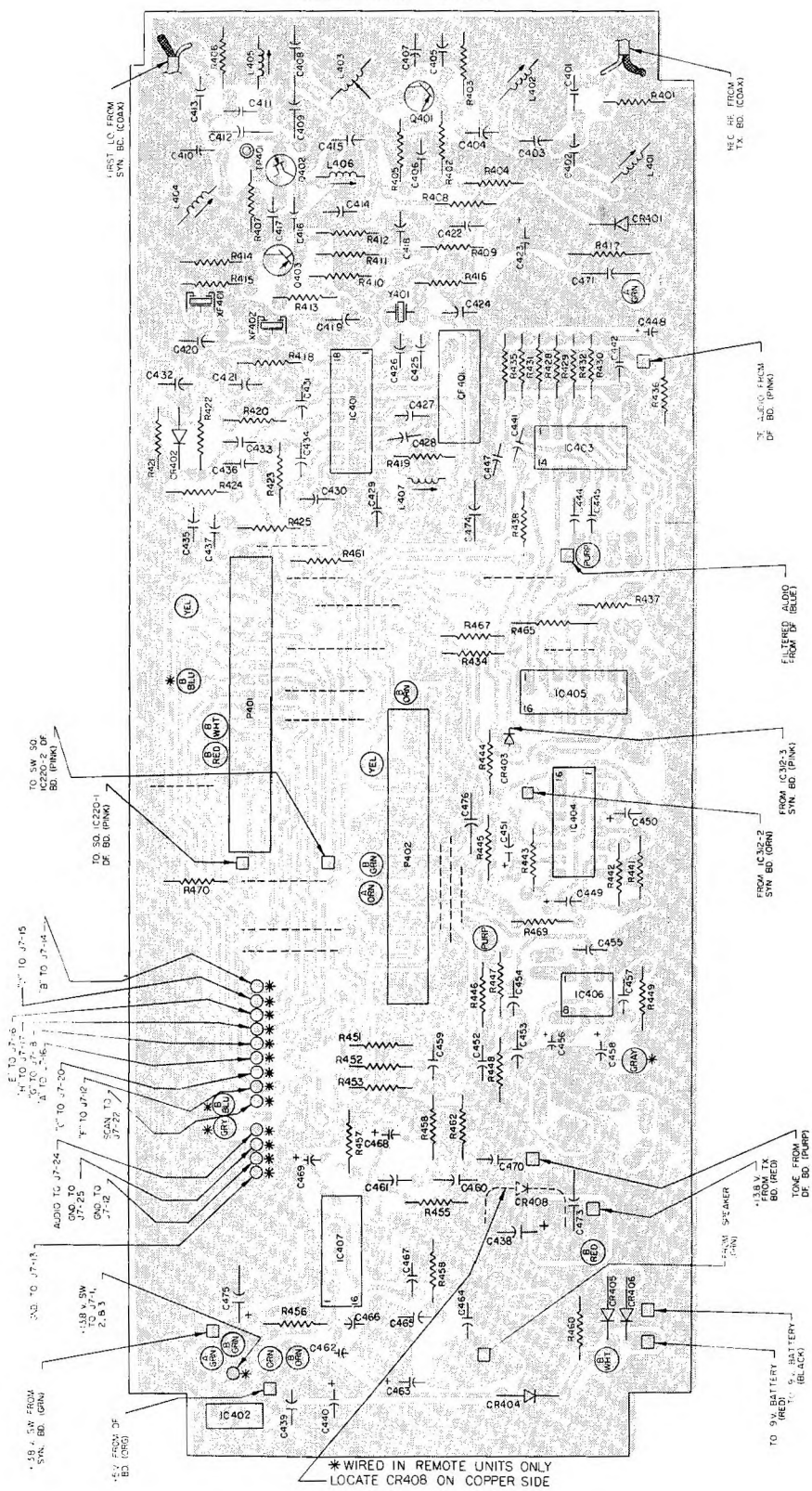
NOTE : LOCATE R356,C350 & C374 ON COPPER SIDE

# RECEIVER BD. 700-509





## RECEIVER BOARD 700-509



## D.F. WAVEFORM GUIDE

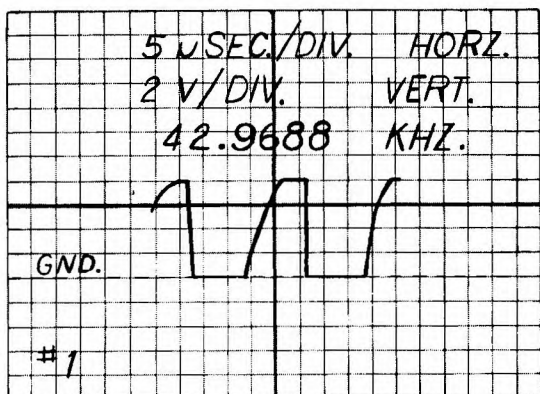
1. Place all front panel switches in the UP position.
2. Key in 1 6 .
3. Turn squelch completely counter clockwise.
4. Place one end of an alligator clip jumper wire to the end of R210 which is nearest Test Point No. 1 (see Parts Placement Diagram). Place the other end of the jumper wire to Test Point No. 2.
5. Turn on unit.
6. Place scope probe on jumper wire nearest R202.
7. See Figure #1.
8. If signal is incorrect, check DF clock on the synthesizer board, R202 and IC206.
9. Place scope probe on IC209, Pin 9.
10. See Figure #2.
11. If signal is incorrect, check IC203, IC206, CR201, CR202 and R201.
12. Place scope probe on IC211, Pin 9.
13. See Figure #3.
14. If signal is incorrect, check IC209 and IC211.
15. Place scope probe on IC202, Pin 9.
16. See Figure #4.
17. If signal is incorrect, check IC202.
18. Place scope probe on IC209, Pin 15.
19. See Figure #5.
20. If signal is incorrect, check IC209 and IC211.
21. Place scope probe on IC202, Pin 8.
22. See Figure #6.
23. If signal is incorrect, check IC206.
24. Place scope probe on IC206, Pin 14.
25. See Figure #7.
26. If signal is incorrect, check IC206.



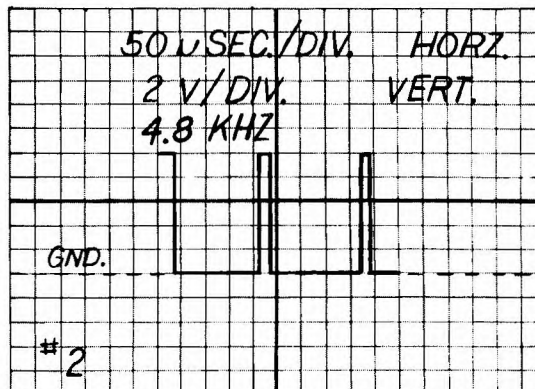
27. Place scope probe on IC206, Pin 12.
28. See Figure #8.
29. If signal is incorrect, check IC206.
30. Place scope probe on IC203, Pin 10.
31. See Figure #9.
32. If signal is incorrect, check IC203 and IC202.
33. Place scope probe on IC203, Pin 11.
34. See Figure #10.
35. If signal is incorrect, check IC203 and IC202.
36. Place scope probe on the end of R213 nearest R211.
37. See Figure #11.
38. If signal frequency is incorrect, check IC211, IC212 and IC210. The signal height should be brought down to 5 volts by a combination of elements described below.
39. Place scope probe on the end of R244 nearest C213.
40. See Figure #12.
41. Place scope probe on IC202, Pin 10.
42. See Figure #13.
43. If signal is incorrect, check IC202.
44. Place scope probe on Ant. Sw Y (blk).
45. See Figure #14.
46. If signal is incorrect, check Q205, Q304, Q305, R220-R228 and C202.
47. Place scope probe on Ant. Sw X (red).
48. See figure #14.
49. If signal is incorrect, check Q201, Q202 and R214-219.
50. Place scope probe on IC215, Pin 6.
51. See Figure #15.
52. If signal is incorrect, check IC213.
53. Place scope probe on IC215, Pin 12.

54. See Figure #15.
55. If signal is incorrect, check IC213.
56. Place scope probe on IC214, Pin 10.
57. See Figure #25.
58. If signal is incorrect, check IC214.
59. Place scope probe on end of R268 which is near C212.
60. See Figure #16.
61. If signal is incorrect, check IC219.
62. Place scope probe on end of R267 which is near board edge.
63. See figure #16.
64. If signal is incorrect, check IC219.
65. Place scope probe on end of R268 which is near C232.
66. See figure #17.
67. If signal is incorrect, check R268 and IC219.
68. Place scope probe on end of R267 away from board edge.
69. See Figure #18.
70. If signal is incorrect, check IC219.
71. Place scope probe on IC219, Pin 5 (with jumper still between TP1 & TP2).
72. See Figure #19.
73. If signal is incorrect, check IC219, IC220, R263, R265, R260, R259, C224 and C226.
74. Place scope probe on IC220, Pins 12 and 13.
75. See Figure #20.
76. If signal is incorrect, check IC219.
77. Place scope probe on IC216, Pin 7.
78. See Figure #21.
79. If signal is incorrect, check IC216 and elements back to TP2.
80. Measure voltage at R254 and R255, both sides of the resistors should be approximately 2 volts.

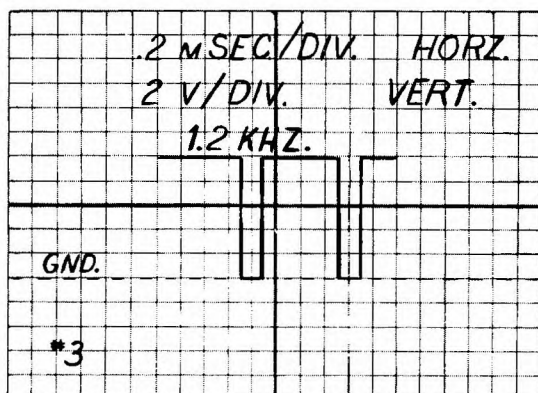
81. If not 2 volts, check IC215, R254 and R255.
82. Place scope probe on end of R258 nearest IC215.
83. See Figure #22.
84. If signal is incorrect, check IC217 and IC215.
85. Place scope probe on end of R241 nearest R238.
86. See Figure #23.
87. If signal is incorrect, check IC218, 10K pot, and all elements back to Figure #22.
88. Place scope probe on end of R242 nearest IC220.
89. See Figure #24.
90. If signal is incorrect, check C212, R242, R243 and CR209-CR211.
91. Place scope probe on IC214, Pin 10.
92. See Figure #25.
93. If signal is incorrect, check IC214.
94. Remove jumper wire from between Test Point No. 1 and Test Point No. 2.
95. Place scope probe on B', J', K', A', C', D' solder pads.
96. See Figure #26-31.
97. If signal is incorrect, check IC201, CR204-CR207, R203 and R204.
98. Place scope probe on end of R205-R207 away from board edge.
99. See Figure #32.
100. If signal is incorrect, check IC207.
101. Place scope probe on end of CR204, CR206 and CR207 nearest edge.
102. See Figure #33.
103. If signal is incorrect, check IC208.



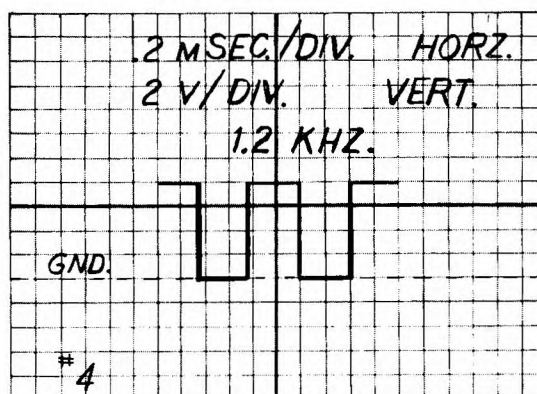
JUMPER  
NEAR R202



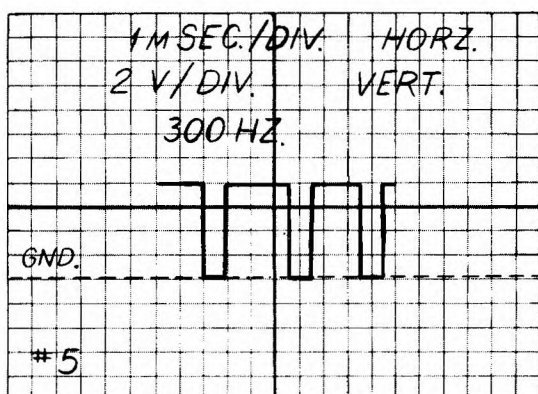
IC 209 PIN 9



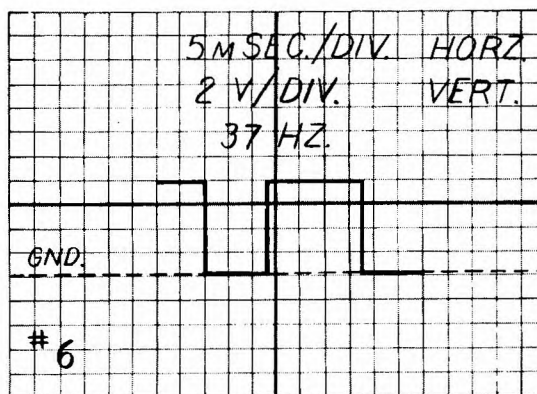
IC 211 PIN 9



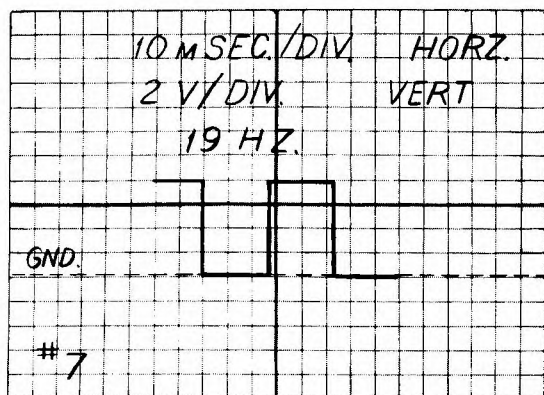
IC 202 PIN 3 & 4



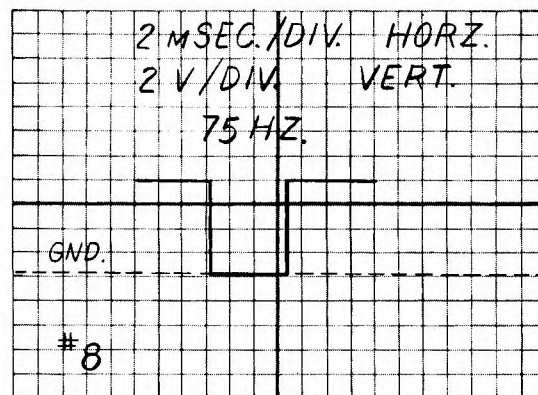
IC 209 PIN 15



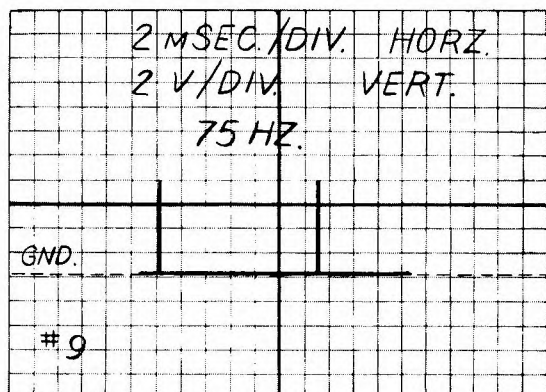
IC 202 PIN 8



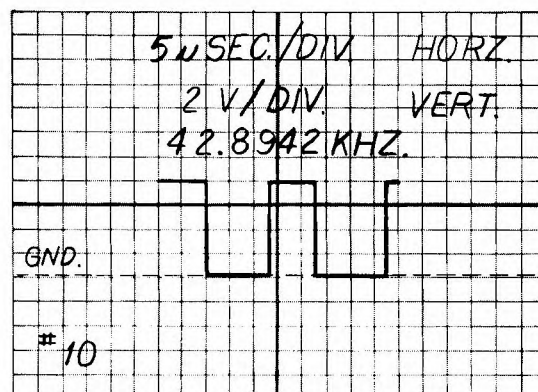
IC 206 PIN 14



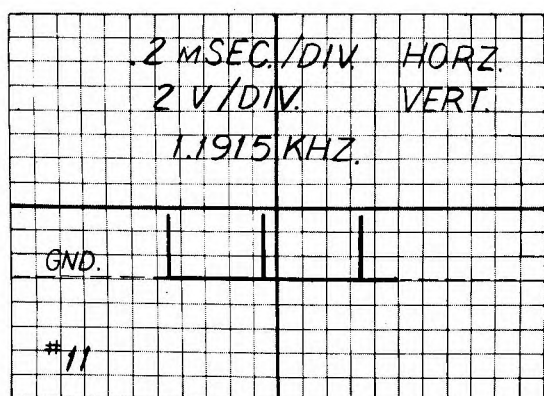
IC 206 PIN 12



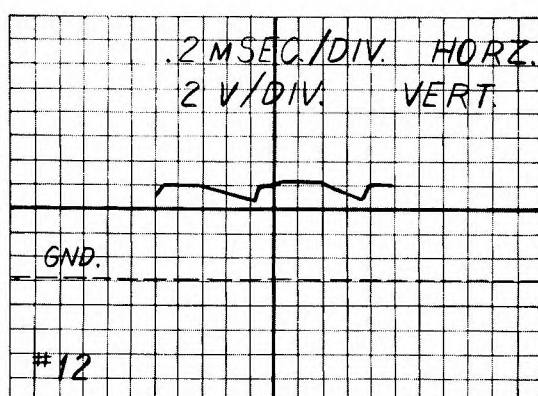
IC 203 PIN 10



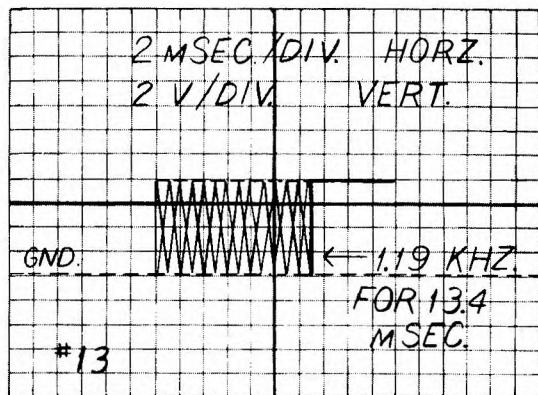
IC 203 PIN 11



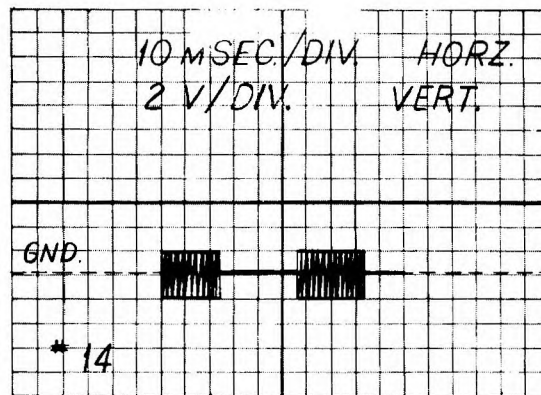
END OF R213 WHICH  
IS NEAR R211



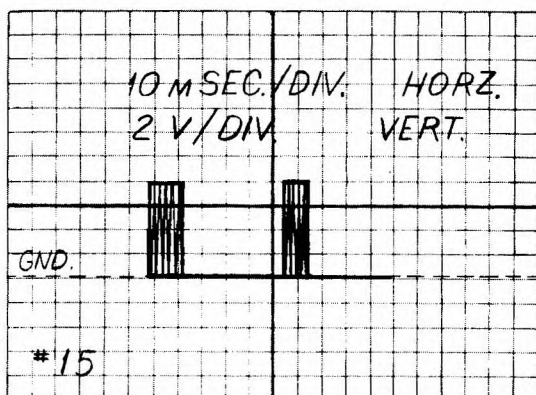
END OF R244 WHICH  
IS NEAR C213



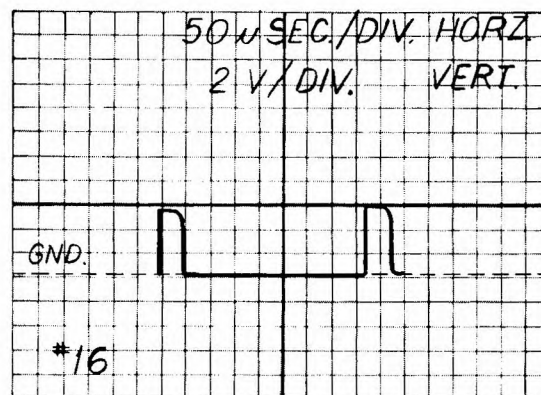
ANTENNA SW Y (BLK)  
ANTENNA SW X (RED)



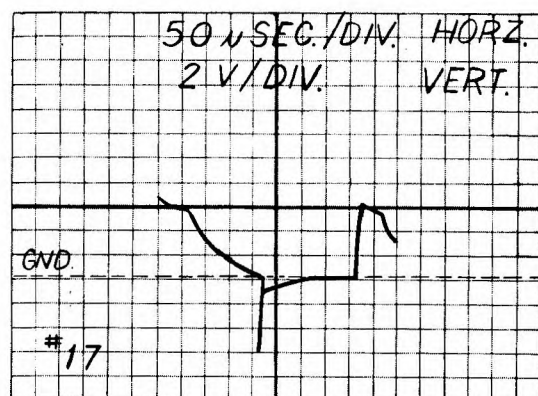
IC 202 PIN 10



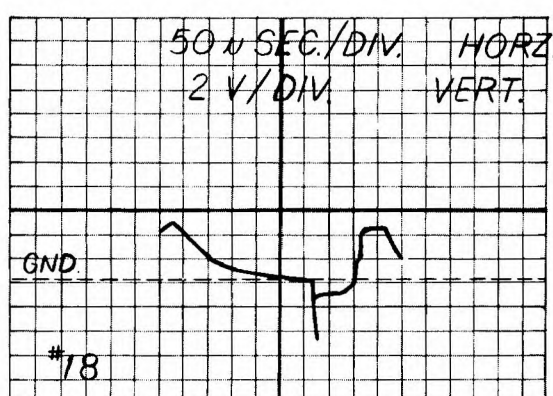
IC 215 PIN 6  
IC 215 PIN 12



END OF R268 WHICH IS  
NEAR C212  
END OF R267 WHICH IS  
NEAR BOARD EDGE

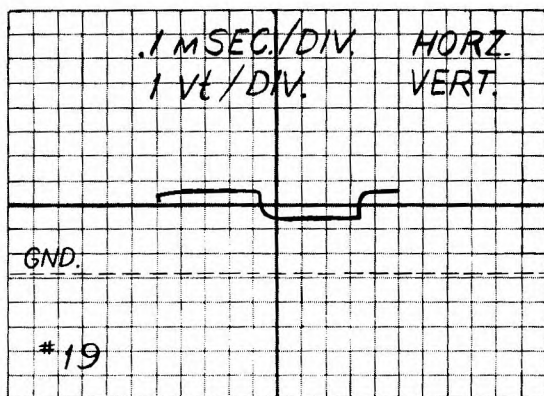


END OF R268 WHICH IS  
NEAR C232 (TRIGGERED  
ON + EDGE OF POSITIVE  
HALF)

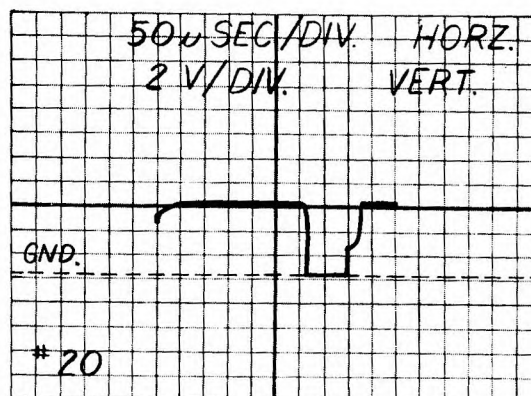


END OF R267 AWAY FROM  
BOARD EDGE (TRIGGERED  
ON + EDGE OF POSITIVE  
HALF)

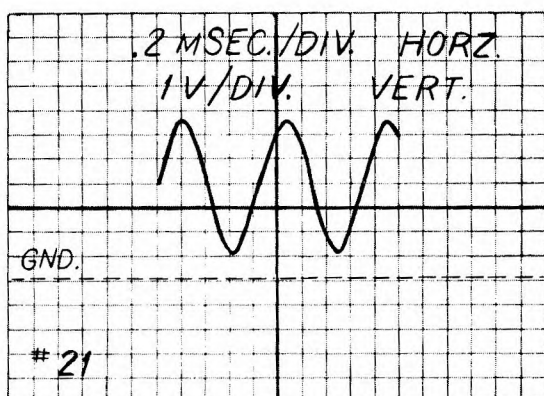




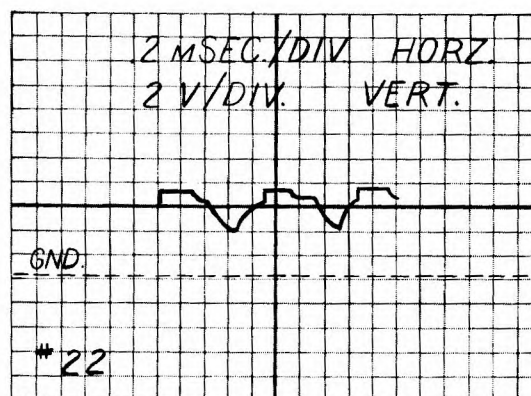
IC 219 PIN 5 WITH JUMPER  
BETWEEN TP201 AND TP202  
(TP1 & TP2)



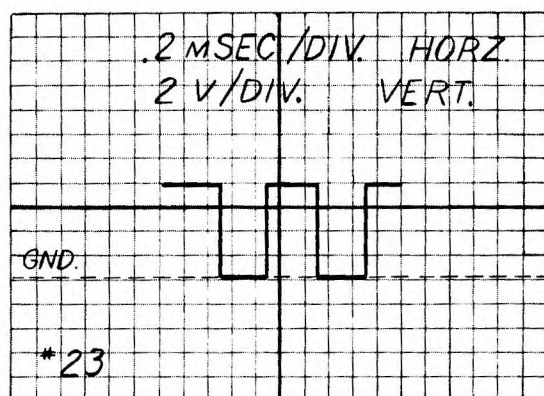
IC 220 PIN 12 & 13



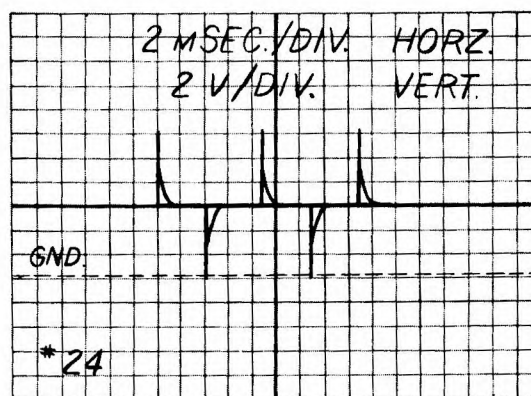
IC 216 PIN 7



END OF R258 NEAREST  
IC 215

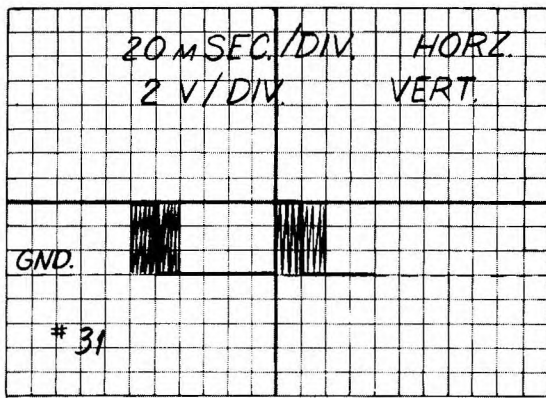


END OF R241 NEAREST  
R238

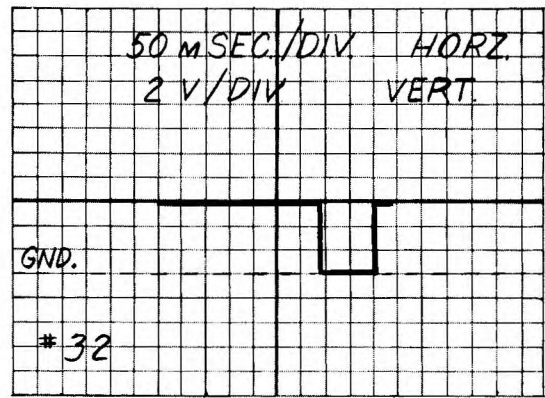


END OF R242 NEAREST  
IC 220

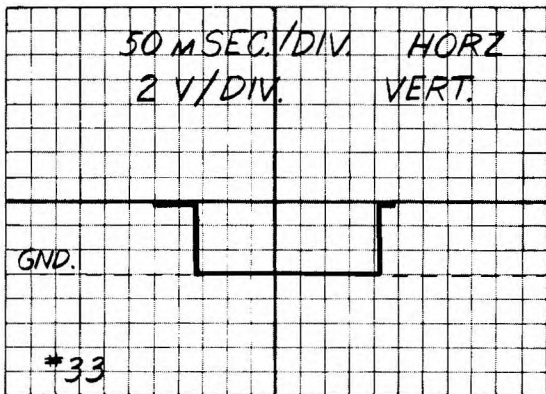




0' TO J7-5



END OF R205 - 207  
AWAY FROM THE BOARD  
EDGE.



END OF CR204, 206, 207  
NEAREST EDGE

## CONTROL BOARD

All voltages taken with DVM. Receiver on manual, channel 16, DF unit ON. Unless otherwise indicated.

	E	B	C
Q101	0	0	5.0
	0	0.8	.15 (WX Activated)
Q102	0	0.2	5.0
	0	0.8	0.1 (Scan)
Q103	0	0.8	0.1
Q104	0	0.1	5.0
Q105	5.0	5.0	4.9
Q106	5.0	5.0	4.9
Q107	5.0	5.0	4.9
Q108	5.0	5.0	4.9
Q109	0	0.7	0.1
Q110	5.0	4.1	4.9

## SYNTHESIZER BOARD

	E(S)	B(G)	C(D)
Q301 (FET)	1.6	0	8.0
Q302	2.1	1.8	7.2
Q303	8.0	7.3	7.9
Q304	0	0.7	0.1
Q305	0	0.1	8.0
Q306	7.9	8.0	0
Q307	0	0.2	13.6
Q308	0	0.7	0.1
Q309	1.4	1.5	7.5

# Synthesizer Board (cont.)

Q310	2.0	2.3	7.0
Q311	3.6	3.6	3.6
Q312	3.6	3.6	3.6
Q313	0	0.4	0.3
Q314	0	0.3	0.4

## RECEIVER BOARD

	E(S)	B(G)	C(D)
Q401	6.4	5.7	0
Q402 (FET)	0.7	0	7.9
Q403	6.7	6.0	2.4
Q404	0	0	3.7
Q405	0	0	4.9
Q406	0	0	5.0

IC401	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
	8.0	7.2	7.4	8.0	1.1	1.1	1.1	8.0	3.7	3.0	2.0	2.4	3.2	0.7	0	0	0	2.1

IC402	1	2	3
	13.7	0	5.0

IC403	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	2.4	2.4	2.4	2.4	5.0	0	0	2.4	2.4	2.4	2.4	0	0	5.0

IC404	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	0	5.0	5.0	0	0	0	5.0	0	0	5.0	5.0	0	0.1	0	5.0	5.0

IC405	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	0	5.0	5.0	0	0	5.0	3.7	0	0	5.0	5.0	0	4.9	4.9	0	5.0

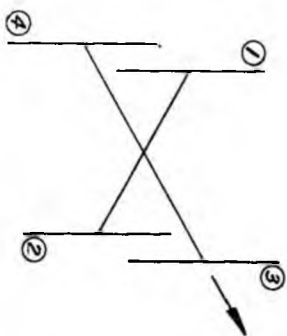
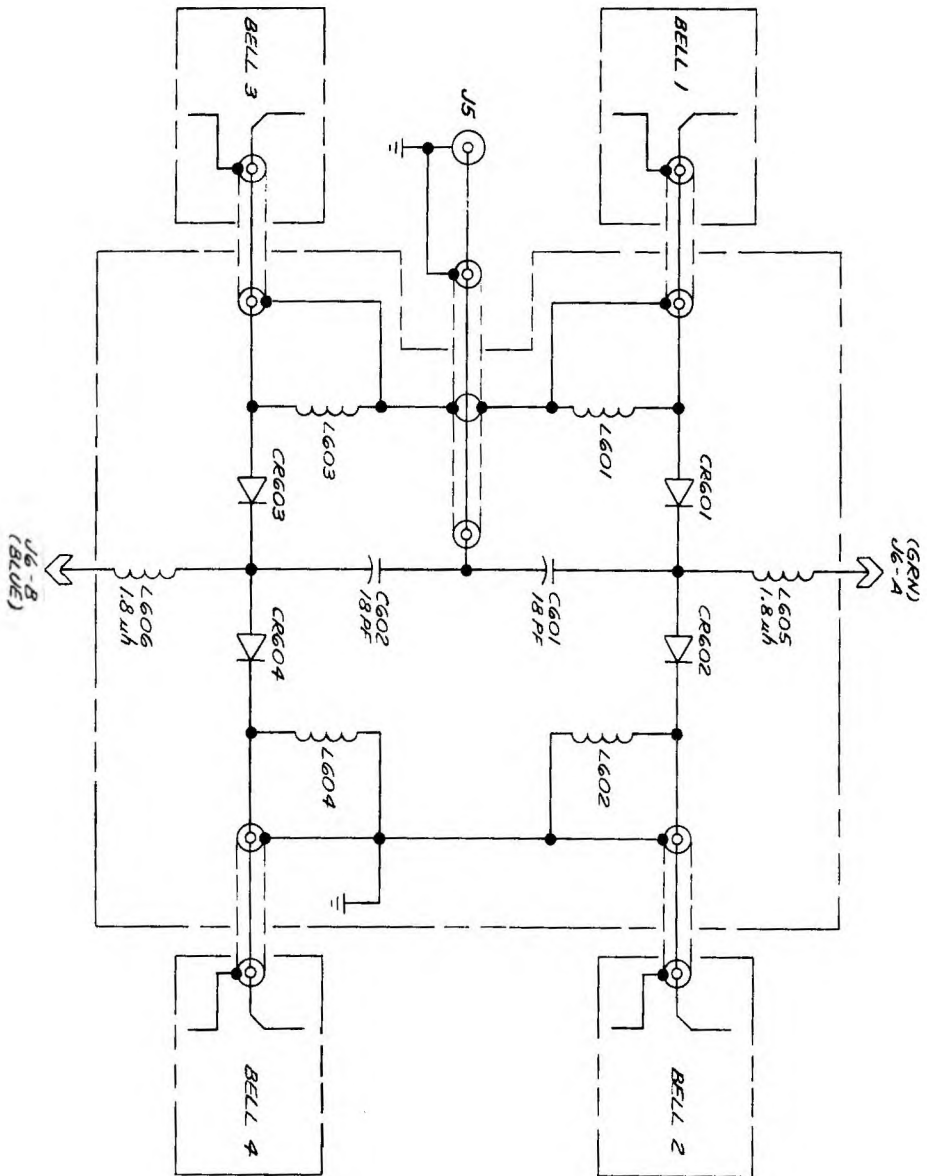
IC406	1	2	3	4	5	6	7	8
	1.3	0	0	0	6.8	13.7	7.0	1.4

IC407	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
	1.3	0.7	13.4	0	0	0	13.6	13.6	6.8	0.7	0	0	0	0	0	7.0

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## CONTROL BOARD

Item No.	Description	Part No.
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### RESISTORS

All Resistors are 1/4 Watt, 5% Unless Otherwise Indicated.

R101	120	4704-0121-032
R102	120	4704-0121-032
R103	120	4704-0121-032
R104	120	4704-0121-032
R105	120	4704-0121-032
R106	120	4704-0121-032
R107	120	4704-0121-032
R108	120	4704-0121-032
R109	120	4704-0121-032
R110	120	4704-0121-032
R111	120	4704-0121-032
R112	120	4704-0121-032
R113	120	4704-0121-032
R114	120	4704-0121-032
R115	120	4704-0121-032
R116	120	4704-0121-032
R118	1K	4704-0102-032
R119	10K	4704-0103-032
R120	1K	4704-0103-032
R121	2.2K	4704-0222-032
R122	3.3K	4704-0332-032
R123	10K	4704-0103-032
R124	2.2K	4704-0222-032
R125	10K	4704-0103-032
R126	10K	4704-0103-032
R127	10K Variable (Squelch)	4750-3281-102
R128	10K Variable (Volume & Sq)	4750-3281-101
R130	56 Ohm, 1Watt, 10%	4711-5060-049
R131	100K	4704-0104-032
R135	120	4704-0121-032
R136	120	4704-0121-032
R137	120	4704-0121-032
R138	120	4704-0121-032
R139	120	4704-0121-032

### CAPACITORS

C101	.05	1502-0503-004
C102	.05	1502-0503-004
C104	470 PF	1523-0471-002

Item No.	Description	Part No.
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### TRANSISTORS

Q101	NPN	4801-0000-016
Q102	NPN	4801-0000-016
Q103	NPN	4801-0000-016
Q104	NPN	4801-0000-016
Q105	PNP (White Top)	4801-0000-060
Q106	PNP (White Top)	4801-0000-060
Q107	PNP (White Top)	4801-0000-060
Q108	PNP (White Top)	4801-0000-060

### INTEGRATED CIRCUITS

IC101	Processor	3130-6060-305
IC102	RAM	3130-3157-647
IC103	Display Driver	3130-3193-519
IC104	Display Driver	3130-3193-519
IC105	Logic	3130-3193-509
IC106	Logic	3130-3157-617
IC107	Logic	3130-3157-617
IC108	Logic	3130-3193-518

### DIODES

CR101	Silicon, Rect	4806-0000-004
CR102	Silicon, Rect	4806-0000-004
CR103	Silicon, Rect	4806-0000-004
CR104	Silicon, Signal	4805-1241-200
CR105	Silicon, Signal	4805-1241-200
CR106	Silicon, Signal	4805-1241-200
CR107	Zener 6.8V	4804-0000-042

### LIGHT EMITTING DIODES

LD102	Yellow	4810-1321-400
LD103	Yellow	4810-1321-400
LD104 thru LD140	Yellow	4810-1320-501

### DISPLAYS

DP101	1 Digit	2000-3285-600
DP102	1 Digit	2000-3285-600



## CONTROL BOARD [continued]

Item No.	Description	Part No.
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### SWITCHES

SW101	Switch, DPDT, (DF)	5114-5147-602
SW102	Switch, DPDT, (INTL-USA)	5114-5147-601
SW103	Switch, DPDT, (Memory)	5114-5147-601
SW104	Switch, DPDT, (NIGHT-DAY)	5114-5147-601
SW105	Switch, DPDT, (CHAN. 16)	5114-5147-602

### CONNECTORS

J101	Connector (6 Cond.)	2105-3286-401
J102	Connector (6 Cond.)	2105-3286-401

## DIRECTION FINDER BOARD

Item No.	Description	Part No.
----------	-------------	----------

### RESISTORS

All Resistors are 1/4W, 5 % Unless Otherwise Indicated.

R201	22K	4704-0223-032
R202	1K	4704-0102-032
R203	22K	4704-0223-032
R204	22K	4704-0223-032
R205	1.8K	4704-0182-032
R206	1.8K	4704-0182-032
R207	1.8K	4704-0182-032
R208	1.8K	4704-0182-032
R209	1K	4704-0102-032
R210	10K	4704-0103-032
R211	10K	4704-0103-032
R212	15K	4704-0153-032
R213	1K	4704-0102-032
R214	1K	4704-0102-032
R215	6.8K	4704-0682-032
R216	6.8K	4704-0682-032
R217	1K	4704-0102-032
R218	680	4704-0681-032
R219	680	4704-0681-032
R220	1K	4704-0102-032
R221	6.8K	4704-0682-032
R222	6.8K	4704-0682-032
R223	1K	4704-0102-032
R224	680	4704-0681-032
R225	680	4704-0681-032
R226	3.3K	4704-0332-032
R227	10K	4704-0103-032
R228	1K	4704-0102-032
R229	1K	4704-0102-032
R230	820	4704-0821-032
R231	10K	4704-0103-032
R232	1.5K	4704-0152-032
R233	10K	4704-0103-032
R234	5.6K	4704-0562-032
R235	82K	4704-0823-032
R236	8.2K	4704-0822-032
R237	220K	4704-0224-032
R238	100K	4704-0104-032
R239	2.2K	4704-0222-032
R240	100K	4704-0104-032
R241	15K	4704-0153-032
R242	47K	4704-0473-032
R243	22K	4704-0223-032
R244	1.5K	4704-0152-032
R245	10K	4704-0103-032
R246	8.2K	4704-0822-032

Item No.	Description	Part No.
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R247	8.2K	4704-0822-032
R248	100K	4704-0104-032
R249	39K	4704-0393-032
R250	3.3K	4704-0332-032
R251	3K, Variable	4751-0302-012
R252	15K	4704-0153-032
R253	100K	4704-0104-032
R254	10K	4704-0103-032
R255	10K	4704-0103-032
R256	10K	4704-0103-032
R257	10K	4704-0103-032
R258	15K	4704-0153-032
R259	100K	4704-0104-032
R260	100K	4704-0104-032
R261	10K	4704-0103-032
R262	Not Used	
R263	82K	4704-0823-032
R264	Not Used	
R265	100K	4704-0104-032
R266	68K	4704-0683-032
R267	68K	4704-0683-032
R268	56K	4704-0563-032
R269	56K	4704-0563-032
R270	56K	4704-0563-032

### CAPACITORS

C201	10 uf, 10V	1513-0100-001
C202	10 uf, 10V	1513-0100-001
C203	1000 uf, 16V	1513-3254-704
C204	.05 uf, 25V	1502-0503-004
C205	10 uf, 25V	1513-0100-003
C206	.047 uf, Mylar	1508-0473-510
C207	.01 uf, Mylar	1508-0103-510
C208	.01 uf, Mylar	1508-0103-510
C209	.0056 uf, Mylar	1508-0562-510
C210	.01 uf, Mylar	1508-0103-510
C211	.01 uf, Mylar	1508-0103-510
C212	470 PF, 5 %, 50V	1506-0471-550
C213	1 uf, 16V	1513-0010-002
C214	10 uf, 10V	1513-0100-001
C215	.1 uf, 12V	1502-0104-004
C216	.1 uf, Tantalum	1515-3291-903
C217	.001 uf, Mylar	1508-0102-510
C218	.1 uf, Mylar	1508-0104-510
C219	33 uf, Tantalum	1515-0330-002
C220	33 uf, Tantalum	1515-0330-002
C221	33 uf, Tantalum	1515-0330-002
C222	33 uf, Tantalum	1515-0330-002
C223	.0056 uf, Mylar	1508-0562-510

### DIRECTION FINDER BOARD [continued]

Item No.	Description	Part No.
C224	.2 uf, 12V	1502-0204-006
C225	.01 uf, Mylar	1508-0103-510
C226	.2 uf, 12V	1502-0204-006
C227	.05 uf, 25V	1502-0503-004
C228	.05 uf, 25V	1502-0503-004
C229	.2 uf, 12V	1502-0204-006
C230	.001 uf, Mylar	1508-0102-510
C231	.001 uf, Mylar	1508-0102-510
C232	.001 uf, Mylar	1508-0102-510
C233	.001 uf, Mylar	1508-0102-510
C234	.05 uf, 25V	1502-0503-004
C235	.05 uf, 25V	1502-0503-004
C236	.05 uf, 25V	1502-0503-004

#### TRANSISTORS

Q201	PNP (White Top)	4801-0000-060
Q202	NPN	4801-0000-016
Q203	PNP (White Top)	4801-0000-060
Q204	NPN	4801-0000-016
Q205	PNP (White Top)	4801-0000-060
Q206	NPN	4801-0000-016
Q207	PNP (White Top)	4801-0000-060
Q208	NPN	4801-0000-016
Q209	PNP (White Top)	4801-0000-060
Q210	NPN	4801-0000-016
Q211	NPN	4801-0000-016

#### INTEGRATED CIRCUITS

IC201	Hex Buffer	3130-3193-520
IC202	Logic	3130-3157-628
IC203	Logic	3130-3157-627
IC204	Hex Buffer	3130-3157-520
IC205	Logic	3130-3193-521
IC206	Counter	3130-3193-522
IC207	Hex Buffer	3130-3193-520
IC208	Logic	3130-3193-521
IC209	Shift Register	3130-3193-523
IC210	Logic	3130-3157-649
IC211	Logic	3130-3157-650
IC212	Counter	3130-3157-651
IC213	Logic	3130-3157-627
IC214	Logic	3130-3157-628
IC215	Logic	3130-3157-648
IC216	OP Amp	3130-3157-637
IC217	OP Amp	3130-3167-909
IC218	OP Amp	3130-3167-914
IC219	Logic	3130-3193-509
IC220	Logic	3130-3157-648
IC221	8V. Regulator	3130-0000-021
IC222	Counter	3130-3193-522

Item No.	Description	Part No.
<b>DIODES</b>		
CR201	Silicon	4805-1241-200
CR202	Silicon	4805-1241-200
CR203	Not Used	
CR204	Silicon	4805-1241-200
CR205	Silicon	4805-1241-200
CR206	Silicon	4805-1241-200
CR207	Silicon	4805-1241-200
CR208	Not Used	
CR209	Silicon	4805-1241-200
CR210	Silicon	4805-1241-200
CR211	Silicon	4805-1241-200

## SYNTHESIZER BOARD

Item No.	Description	Part No.
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### RESISTORS

All Resistors are 1/4W, 5% Unless Otherwise Indicated.

R301	15	4704-0150-032
R302	12K	4704-0123-032
R303	2.2K	4704-0222-032
R304	68K	4704-0683-032
R305	22K	4704-0223-032
R306	100K	4704-0104-032
R307	15K	4704-0153-032
R308	270K	4704-0274-032
R309	1K	4704-0102-032
R310	33	4704-0330-032
R311	10K	4704-0103-032
R312	100	4704-0101-032
R313	4.7K	4704-0472-032
R314	47	4704-0470-032
R315	220	4740-0221-032
R329	2.7K	4704-0272-032
R337	1K	4704-0102-032
R338	15K	4704-0153-032
R340	1K	4704-0102-032
R341	2.7K	4704-0272-032
R342	8.2K	4704-0822-032
R343	470	4704-0471-032
R344	150	4704-0151-032
R354	Variable, 10K	4751-0103-001
R355	15K	4704-0153-032
R357	Not Used	
R358	Not Used	
R360	100	4704-0101-032
R361	8.2K	4704-0822-032
R362	270	4704-0271-032
R363	4.7K	4704-0271-032
R364	10K	4704-0103-032

### CAPACITORS

C301	33 uf, 10V, Tantalum	1515-0330-002
C302	1000 uf, 16V	1513-3254-704
C303	1 uf, 50V	1513-0010-004
C304	.068 uf, Mylar	1508-0683-610
C305	39 PF, 5%, NPO	1500-0390-550
C306	.015 uf	1508-0153-510
C307	10 PF, 10%, NPO	1500-0100-605
C308	470 PF	1523-0471-002
C309	8.2 PF, 10%, NPO	1500-0829-905

Item No.	Description	Part No.
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C310	6.8 PF, 10%, NPO	1500-0689-905
C311	.001 uf	1503-0102-003
C312	470 PF	1523-0471-002
C313	.001 uf	1503-0102-003
C314	.001 uf	1503-0102-003
C315	.001 uf	1503-0102-003
C316	470 PF	1523-0471-002
C317	.05 uf	1502-0503-004
C318	470 PF	1538-0471-601
C319	22 PF, 5%, NPO	1500-0220-550
C320	470 PF	1523-0471-002
C333	.05 uf	1502-0503-004
C338	4.7 PF, 10%, NPO	1500-0479-905
C339	.001 uf	1503-0102-003
C340	.001 uf	1503-0102-003
C341	56 PF, 5%, NPO	1524-0560-002
C342	18 PF, 10%, NPO	1500-0180-650
C343	Trimmer, 2.2-20 PF	1517-0000-034
C344	470 PF	1523-0471-002
C345	.2 uf	1502-0204-006
C347	.05 uf	1502-0503-004
C348	.05 uf	1502-0503-004
C349	.05 uf	1502-0503-004
C350	150 PF	1523-0151-002
C351	470 PF	1538-0471-601
C352	6.8 PF, 10%, NPO	1500-0689-905
C353	.47 PF	1510-0478-900
C354	470 PF	1523-0471-002
C355	10 uf, 16V	1513-0100-002
C357	.001 uf	1503-0102-003
C359	5.6 PF, 10%, NPO	1500-0569-905
C360	470 PF	1538-0471-601
C361	8.2 PF, 10%, NPO	1500-0829-905
C362	56 PF, 5%, NPO	1524-0560-002
C363	1 uf, 50V	1513-0010-004
C367	10 uf, 16V	1513-0100-002
C368	120 PF	1506-0121-550
C369	.47, 15V Tantalum	1515-0478-008
C370	4.7 PF, 10%, NPO	1500-0479-905
C371	.001 uf	1503-0102-003
C373	.001 uf	1538-0102-703

### COILS

L301	VCO	1800-5149-701
L302	RF	1800-3152-027
L303	RF	1800-3152-019
L306	Choke	1803-3268-210
L307	Choke	1803-3268-211
L309	RF	1800-3152-027

## SYNTHESIZER BOARD [continued]

Item No.	Description	Part No.	Item No.	Description	Part No.
----------	-------------	----------	----------	-------------	----------

### TRANSISTORS

Q301	FET	4811-0000-020
Q302	NPN (Red Top)	4801-0000-935
Q309	NPN (Red Top)	4801-0000-035
Q310	NPN (Red Top)	4801-0000-035
Q313	NPN	4801-0000-016

### INTEGRATED CIRCUITS

IC302	OP Amp	3130-3167-914
IC303	Logic	3130-3157-635
IC304	Logic	3130-3157-635
IC305	Reference Detector	3130-6059-600
IC306	Logic	3130-3157-636
IC307	Logic	3130-3157-636
IC308	Logic	3130-3193-515
IC309	Logic	3130-3193-515
IC310	Logic	3130-3193-515
IC311	Logic	3130-3193-515
IC312	Logic	3130-3157-631
IC313	Counter	3130-6060-603
IC314	Logic	3130-3157-631
IC315	8V. Regulator	3130-0000-021
IC316	5V. Regulator	3130-0000-019

### DIODES

CR301	Varactor	4809-0000-001
CR304	Silicon	4805-1241-201

### CRYSTAL

Y301	11.0 MHz	2338-3283-205
------	----------	---------------

## RECEIVER BOARD

Item No.	Description	Part No.
----------	-------------	----------

### RESISTORS

All Resistors are 1/4 Watt, 5% Unless Otherwise Indicated.

R401	100K	4704-0104-032
R402	4.7K	4704-0472-032
R403	12K	4704-0123-032
R404	100	4704-0101-032
R405	390	4704-0391-032
R406	33K	4704-0333-032
R407	1.5K	4704-0152-032
R408	680	4704-0681-032
R409	100	4704-0101-032
R410	270	4704-0271-032
R411	10K	4704-0103-032
R412	27K	4704-0273-032
R413	220	4704-0221-032
R414	1K	4704-0102-032
R415	470	4704-0471-032
R416	33	4704-0330-032
R417	220 Ohm, 1/2 Watt, 10%	4701-0221-044
R418	2.2K	4704-0222-032
R419	68K	4704-0683-032
R420	10K	4704-0103-032
R421	270K	4704-0274-032
R422	10K	4704-0103-032
R423	1.5 Meg	4704-0155-032
R424	22K	4704-0223-032
R425	22K	4704-0223-032
R428	100K	4704-0104-032
R429	100K	4704-0104-032
R430	100K	4704-0104-032
R431	100K	4704-0104-032
R432	100K	4704-0104-032
R433	100K	4704-0104-032
R434	100	4704-0101-032
R435	10K	4704-0103-032
R436	10K	4704-0103-032
R437	27K	4704-0273-032
R438	100K	4704-0104-032
R441	100K	4704-0104-032
R442	220K	4704-0224-032
R443	100K	4704-0104-032
R444	100K	4704-0104-032
R445	100K	4704-0104-032
R446	22K	4704-0223-032
R447	4.7K	4704-0472-032

Item No.	Description	Part No.
----------	-------------	----------

R448	100K	4704-0104-032
R449	10	4704-0100-032
R450	1K	4704-0102-032
R451	22K	4704-0223-032
R452	1K	4704-0102-032
R453	22K	4704-0223-032
R454	4.7K	4704-0472-032
R455	47K	4704-0473-032
R456	100	4704-0101-032
R457	15	4704-0150-032
R458	2.2	4704-0229-032
R460	470K	4704-0474-032
R461	1K	4704-0102-032
R465	10K	4704-0103-032
R467	10K	4704-0103-032
R469	10K	4704-0103-032

### CAPACITORS

C401	6.8 PF, 10% NPO	1500-0689-905
C402	12 PF, 10%, NPO	1500-0120-605
C403	2.2 PF, 10%, NPO	1500-0229-905
C404	22 PF, 10%, NPO	1500-0220-605
C405	22 PF, 10%, NPO	1500-0220-605
C406	.01 uf, 50V	1502-0103-007
C407	.001 uf, 50V	1523-0102-002
C408	15 PF, 10%, NPO	1500-0150-605
C409	.68 PF, 10%	1510-0688-900
C410	5.6 PF, 10%, NPO	1500-0569-905
C411	5.6 PF, 10%, NPO	1500-0569-905
C412	.27 PF, 10%	1510-0278-900
C413	1.5 PF, + .25 PF, NPO	1500-0159-205
C414	.01 uf, 50V	1506-0103-550
C415	120 PF, 5%	1506-0121-550
C416	.001 uf, 20%	1523-0102-002
C417	.01 uf, 50V	1502-0103-007
C418	.01 uf, 50V	1502-0103-007
C419	.01 uf, 50V	1502-0103-007
C420	Part of Filter Set	
C421	.001 uf, 50V	1523-0102-002
C422	.01 uf, 50V	1502-0103-007
C423	220 uf, 16V	1513-0221-002
C424	.2 uf, 12V	1502-0204-006
C425	33 PF, 5%, NPO	1500-0330-550



# RECEIVER BOARD [continued]

Item No.	Description	Part No.	Item No.	Description	Part No.
C426	68 PF, 5%, NPO	1524-0680-002	COILS		
C427	.1 uf, 12V	1502-0104-006	L401	Ant. Input	1800-3152-019
C428	.05, 16V	1502-0503-003	L402	Ant.	1800-3152-009
C429	150 PF, 50V	1523-0151-002	L403	RF	1800-3152-023
C430	.001 uf, 50V	1523-0102-002	L404	RF	1800-3152-002
C431	.2 uf, 12V	1502-0204-006	L405	RF	1800-3191-401
C432	.2 uf, 12V	1502-0204-006	L406	1F	1800-3191-401
C433	.002 uf, 50V	1523-0202-002	L407	Quadrature	1800-6055-801
C434	6.8 PF, 10%, NPO	1500-0689-905	TRANSISTORS		
C435	27 PF, 10%, NPO	1500-0270-605	Q401	PNP	4801-0000-026
C436	150 PF, 50V	1523-0151-002	Q402	FET	4811-0000-030
C437	150 PF, 50V	1523-0151-002	Q403	PNP	4801-0000-026
C438	1000 uf, 16V	1513-3254-704	INTEGRATED CIRCUITS		
C439	.2 uf, 12V	1502-0204-006	IC401	IF	3130-6056-500
C440	100 uf, 16V	1513-0101-002	IC402	Regulator, 5V	3130-0000-022
C441	.2 uf, 12V	1502-0204-006	IC403	Switch	3130-3157-648
C442	.2 uf, 12V	1502-0204-006	IC404	Logic	3130-3193-509
C443	.2 uf, 12V	1502-0204-006	IC405	Logic	3130-3193-509
C444	.2 uf, 12V	1502-0204-006	IC406	Audio	3130-3167-910
C445	.1 uf, 12V	1502-0104-006	IC407	Audio	3130-3248-801
C446	.1 uf, 12V	1502-0104-006	DIODES		
C447	.1 uf, 12V	1502-0104-006	CR401	Zener, 8.2V	4808-0000-027
C448	10 uf, 16V	1513-0100-002	CR402	Silicon, Signal	4805-1241-201
C449	4.7 uf, Tantalum	1515-3291-901	CR403	Germanium	4807-1233-900
C450	.47 uf, Tantalum	1515-3291-902	CR404	Germanium	4807-1233-900
C451	.47 uf, Tantalum	1515-3291-902	CR405	Germanium	4807-1233-900
C452	.001 uf, 50V	1523-0102-002	CR406	Zener, 4.3V	4808-0000-039
C453	.047 uf, Mylar	1508-0473-610	CRYSTALS AND FILTERS		
C454	.1 uf, 12V	1502-0104-006	Y401	Crystal, 20.945 MH	2301-3151-607
C455	.1 uf, 12V	1502-0104-006	CF401	Ceramic Filter 455 KHz	2700-0000-009
C456	10 uf, 16V	1513-0100-002	XF401 &		
C457	.05 uf, 16V	1502-0503-003	XF402 &		
C458	47 uf, 16V	1513-0470-002	C420	Set, Filters, Crystal, 21.4 MHz	2705-3286-200
C459	.001 uf, 50V	1523-0102-002			
C460	.068 uf, Mylar	1508-0683-610			
C461	.1 uf, 12V	1502-0104-006			
C462	22 uf, 16V	1513-0220-002			
C463	220 uf, 16V	1513-0221-002			
C464	.005 uf	1503-0502-001			
C465	.2 uf, 12V	1502-0204-006			
C466	.0027 uf, Mylar	1508-0272-610			
C467	.033 uf, Mylar	1508-0333-610			
C468	47 uf, 16V	1513-0470-002			
C469	47 uf, 16V	1513-0470-002			
C471	470 PF, TC	1538-0471-601			
C473	470 PF, TC	1538-0471-601			
C474	.001 uf, TC	1538-0102-703			
C475	470 PF, TC	1538-0471-601			
C476	470 PF, TC	1538-0471-601			

## CHASSIS ELECTRICAL PARTS

Description	Part No.
Control, DF Cal., 10K	4751-3283-401
Jack, Speaker, Ext & Hail	2101-3262-400
Antenna Connector	2105-0000-056
Connector Housing, Male, (2 Cond.)	210-5120-402
Connector Housing, Male, (3 Cond.)	2109-5120-403
Contact, Female (used with above housing)	2107-3244-102
CAP., Feedthru, .001 (11 used)	1521-5129-800
Keyboard	2001-6064-200
Lamp (Panel)	3901-0000-011

## CHASSIS MECHANICAL PARTS

Front Panel	1400-7046-701
Lens (DF)	3900-6064-401
Lens, (CH)	3900-6064-404
Case Top	1411-7046-902
Case Bottom	1411-7047-001
Foot, Bumper	1402-3291-201
Knob, Vol & Squelch	2402-5149-301

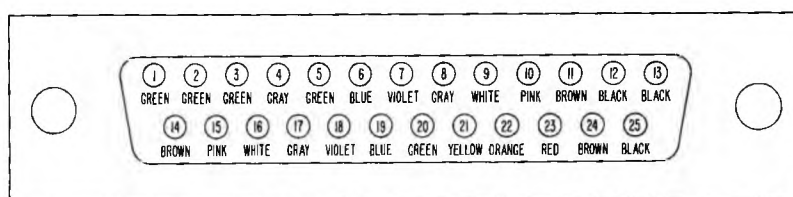
## DF ANTENNA

Dish Assembly, Complete	7114-5154-100
Dipole Element Assembly	1203-3291-701

## WIRING INSTRUCTIONS FOR REMOTE PLUG

### 1. REMOTE CONNECTIONS IN THE MAIN RADIO

A J7 Female Connector with 25 pre-cut leads attached is provided for installation in the main radio. Eighteen leads are to be installed in the Receiver Board and the remaining seven are for D-F Board. Holes were drilled in the Receiver and D-F Boards at the factory with pads on the bottom side of the Receiver Board and pads on both sides of the D-F Board. The component layout drawings in the back of the Polaris NC7200 service manual shows where connections are to be made on the Receiver and D-F Boards. Connections are described by reference to numbered leads on the J7 connector and color of the lead. Viewing the connector from the side with leads attached, the following number and color scheme applies:



Note: The connector is to be installed in the radio chassis with the connector mounting plate on the inside, so begin making connections with the connector hanging loose above the Receiver Board. Do not run leads through connector mounting hole.

### 2. RECEIVER BOARD CONNECTIONS

To lift the Receiver Board, which is the top horizontal board in the back half of the radio, it is necessary to remove the screw from the voltage regulator IC. Also remove the coax from the right front corner of the Receiver Board at the Malco Pins.

Caution: The radio should not be operated with the Receiver Board out of place, as damage to control Board IC's is possible.

For simple installation the following order of connections may be followed:

- |     |          |        |  |
|-----|----------|--------|--|
| 1.  | J7-4     | Gray   |  |
| 2.  | J7-1,2,3 | Green  | Note: Insert one lead in hole and solder other two to it.          |
| 3.  | J7-13    | Black  |  |
| 4.  | J7-12    | Black  |  |
| 5.  | J7-25    | Black  |  |
| 6.  | J7-24    | Brown  |  |
| 7.  | J7-23    | Red    |  |
| 8.  | J7-22    | Orange | Note: Route the following leads (3 thru 16) between the 220 uf     |
| 9.  | J7-21    | Yellow | electrolytic capacitor and the IC heat shield and under the 47 Ohm |
| 10. | J7-20    | Green  | resistor attached to the top of the shield.                        |
| 11. | J7-19    | Blue   |  |
| 12. | J7-18    | Violet |  |
| 13. | J7-17    | Gray   |  |
| 14. | J7-16    | White  |  |
| 15. | J7-15    | Pink   |  |
| 16. | J7-14    | Brown  |  |

Note: At this time two jumper wires need to be installed on the Receiver Board in holes marked on the Receiver Board drawing with a color and a star. Blue and Gray jumper wires

are provided for this purpose. The Blue wire connects the holes marked "Blue B" on the drawing. One hole is in front of the connection from J7-22 and the other is in front of the connector marked P401 on the drawing. The Gray jumper connects the holes marked "Gray" on the drawing. One is located in front of the connection from J7-24 and the other is located directly behind the 47 uf electrolytic capacitor marked C458 on the drawing.

### 3. D-F BOARD CONNECTIONS

To lift the D-F Board, which is the top horizontal board at the front of the radio, it is necessary to remove three wires near the control board at the Die-Tech Pins. These wires are: (1) The Blue D-F on/off line from the transmit board, (2) The gray clock line from the Synthesizer Board and, (3) The white data line from the Synthesizer Board. Extra Die-Tech pins are included in the kit in case they need to be replaced. The leads may be installed in the following order:

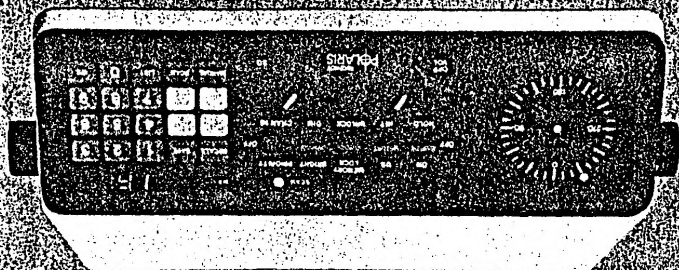
Note: Solder connections on both sides of board.

1. J7-10      Pink
2. J7-9        White
3. J7-8        Gray
4. J7-7        Violet
5. J7-6        Blue
6. J7-5        Green
7. J7-11      Brown

4. Mount the J7 Female connector in the chassis with the connector mounting plate on the inside.
5. A wire-tie is provided so that the seven wires which attach to the D-F Board can be tied together where they cross from the Receiver Board to the D-F Board.

**REGENCY POLARIS  
ONE YEAR LIMITED WARRANTY**

1. The Regency Polaris units: NC7200, NC7100, MT7000, MT1200 are warranted to the original or subsequent purchasers to be free of defects in material and workmanship for a period of one (1) year from the date of purchase as shown on the original consumer purchaser's receipt.
2. Warranty service will be provided free of charge if the unit is delivered to a Regency Polaris authorized service station accompanied by original consumer proof of purchase. Any transportation, removal or reinstallation charges will be paid by the purchaser whenever incurred in connection with this warranty. In absence of proof of purchase receipt the warranty period shall be one (1) year from the date of manufacture as indicated by serial number on unit. Purchaser need not return the registration card to obtain warranty service.
3. The warranty does not apply to units subject to misuse, neglect, accidents, incorrect wiring not our own, improper installation, or units used in violation of the instructions furnished by us. This warranty excludes any incidental and consequential damages connected with failure or defect in the product.
4. This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.



# Regency Polaris NC7100 Owners Manual



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## GENERAL DESCRIPTION

Your Regency Polaris NC7100 is a state of the art computer controlled VHF Marine Band (156-163 MHz) FM receiver which also features unique channel scanning and direction finding capability.

The Direction Finder is capable of indicating relative bearing to any station transmitting on the VHF Marine Band including other boats. The unique display, a circle of 36 yellow light emitting diodes (LED'S), is capable of resolving directions with an accuracy of  $\pm 5^\circ$ .

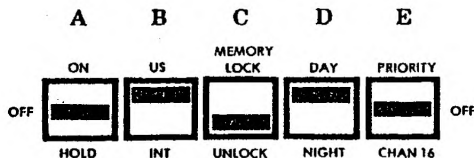
The receiver can be programmed to operate on any one of the 55 channels as allocated by the FCC. It can also scan a minimum of 2 channels or up to all 55 available channels.

The frequencies for the receiver are synthesized and controlled by the micro-processor so that no crystals are required.

Entries are made by touching the keyboard pressure pads. A "beep" is heard each time a key is pressed to indicate that an action has taken place. The Polaris NC7100 is truly an innovation in VHF Marine Electronics.

## FUNCTION SWITCHES

Before operating your NC7100, it is important to locate the function switches and program keys to understand their uses.



**NOTE:** Set these switches at positions indicated prior to initial power-up.

- A. Direction Finder Switch—Used for turning the direction finder on and off. Also for holding the Direction Finder indicator on the last bearing received after the signal is no longer present. (See Direction Finder section on page 16).
- B. Channel Select Switch—Allows selection of U.S. or International frequencies (See page 15).
- C. Memory Lock Switch—Used for storing your local channels for automatic recall. (See page 14.)

- D. Day/Night Switch— Controls the brightness of the display and the illumination of the keyboard. (See page 17.)
- E. Channel 16 Switch— When the Channel 16 switch is in the "PRIORITY" position, channel 16 will be sampled once per second for activity. One can go directly to MANUAL on channel 16 by moving the switch to "CHAN 16". (See page 10).

## Volume & Squelch



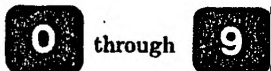
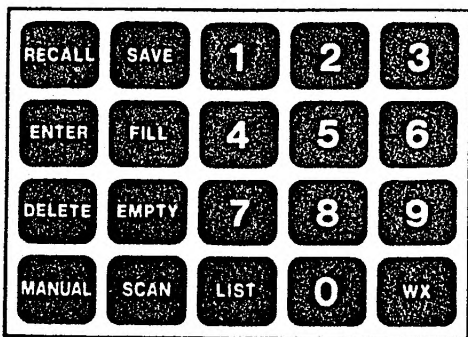
(Note: Set these knobs at positions indicated prior to initial power-up)

**Volume**— This control adjusts the audio to the most comfortable listening level.

**Squelch**— Allows operator to eliminate annoying background noise when no message is being received.

## PROGRAM PANEL

The Polaris NC7100 keyboard has 20 touch-entry keys for easy entry of all data. The keyboard is used to select the desired mode of operation and also determines the receive channels.



through

Use these keys to enter channel numbers.



Provides for manual selection of any valid channel. (See page 9).



Puts the unit in the scan mode (See page 11).



Automatically enters all 55 VHF marine channels into the operating memory. (See page 10).



All channels will be removed from the operating memory. (See page 12).



Displays the channels in the memory in numerical order for verification. (See page 12).



thru



Provides for listening to any one of the 4 weather frequencies. (See page 17).



Used for entering displayed channels into the operating memory. (See page 12).



Allows you to remove any displayed channel from the operating memory. (See page 11).



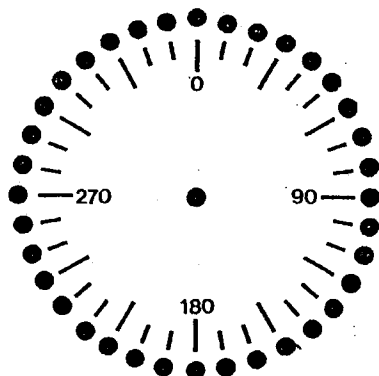
Permits your personal set of channels to be stored in a separate semi-permanent memory. (See page 14).



Recalls the channels in your personal set from the semi-permanent memory. (See page 14).

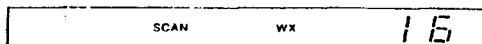
## DISPLAYS

### DF Display



The Direction Finder display consists of 36 yellow LED'S arranged in a circle. The numbers around the perimeter indicate degrees in determining the relative direction of an incoming signal. The LED'S flash each in turn giving the appearance that they are circling clockwise. When a signal is received, the circling stops and one of the LED'S remains lighted, indicating the direction of the transmitter to  $\pm 5^\circ$  accuracy. See Direction Finder section on page 16)

### Channel Display



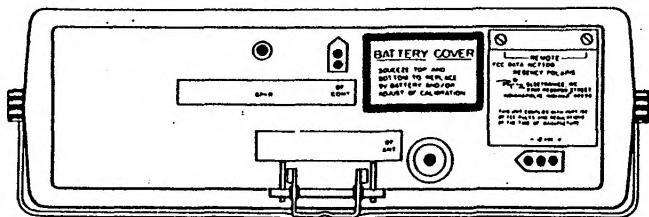
**SCAN**—A yellow LED will flash rapidly when the unit is scanning (see page 11) and blink slowly in the LIST mode (see page 12).

**WX** —A yellow LED indicates one of the 4 weather channels is being monitored.

**16** —The channels appear as yellow numbers in the digital read-out located to the right of "WX".



## PREPARATION FOR USE



### 1. Marine (VDC) Installation

The NC7100 receiver is designed for marine mobile installation in any vessel that has a 12 VDC negative ground system. The red lead with the fuse holder must be connected to the positive terminal of the battery. The black lead should be connected to the negative terminal or to a metal hull which is grounded to the negative terminal of the battery. In the event that the battery is remotely located, it may be necessary to install necessary wires for this purpose.

2. Connect the speaker to the rear panel by inserting the plug into the jack marked "SPKR".
3. Install the nine volt battery (included with the unit) by removing the battery cover and attaching the battery to the clip supplied. Place the battery in position and snap the battery cover tightly.
4. DF Antenna installation

1. Attach the side and swivel base mounting brackets to the side of the vessel (See Fig. 1).
2. Connect the antenna to the top of the mast and tighten.
3. Connect the Direction Finder control cable and the DF Antenna coax to the antenna itself (See Fig. 1).
4. Locate the antenna dipole marked with a black dot.
5. Attach the antenna mast to the swivel base mount and tighten by rotating the antenna clockwise.
6. Next, insert the mast into the side mounting bracket. Do not tighten completely.

**NOTE:** The dipole marked with the black dot must point to the bow of the vessel for proper operation (See Fig. 2). To adjust this, turn the antenna mast at the base until the dot is properly aligned. Now tighten the side mounting bracket

- and the mast is extremely secure.
7. Insert the Direction Finder control cable plug to the "DF CONT" jack and the Direction Finder antenna plug to the "DF ANT" jack on the rear panel of your unit. (See rear panel diagram). 20' of cable are provided. If proper operation does not result, consult your Regency Polaris dealer.

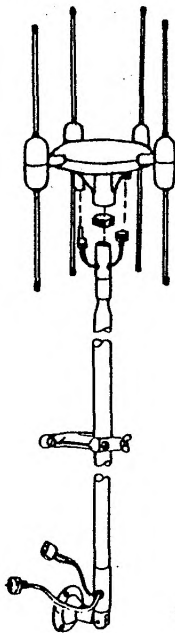


Fig. 1

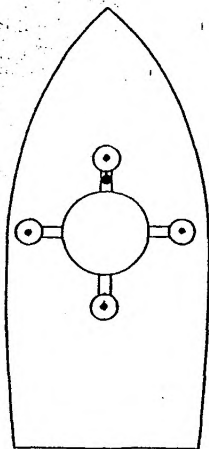
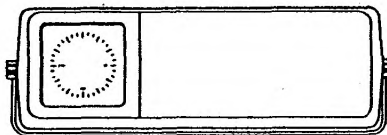


Fig. 2

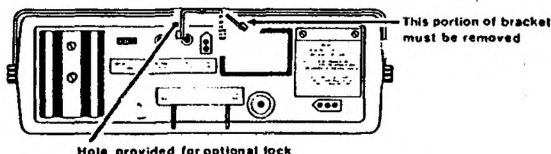
6. The NC7100 is equipped with a mounting tray that allows 3 different mounting positions, 1) console, 2) overhead or 3) bulkhead.

For overhead or bulkhead mounting, the tray must be reversed.

#### CONSOLE



#### OVERHEAD/BULKHEAD



We recommend you see your Regency Polaris marine dealer for proper assistance.

#### INITIAL OPERATION CHECKS

1. **OFF/VOL Knob**—The OFF/VOL knob is used to apply power to the unit as well as controlling the volume level. Turning the knob clockwise turns the unit on. A click followed by a "beep" tone indicates the unit is on. Continuing to turn the knob clockwise increases the volume. Channel 16 will automatically appear in the display. The unit will also be in the manual mode.
2. **SQ Knob**—Set the squelch by turning the knob clockwise until noise is heard. The knob should be turned counter-clockwise until the noise just disappears. Your unit should now scan properly (when activated) and be free of noise between transmissions.
3. **Activate the Direction Finder** by turning the ON/HOLD switch to "on". After a short delay the 36 yellow LED'S will begin circling clockwise at the approximate rate of 2 rotations per second.
4. **Check the day/night switch** by moving it to the "Night" position. The "16" in the display and the Direction Finder display will both dim

while the  gram panel becomes illuminated.

5. When the Channel 16 switch is in the "PRIORITY" position, and the receiver is on another active channel, Channel 16 will be sampled at regular intervals for activity. To verify this, enter any of the working VHF marine channels:

Example:

PRESS



(a "beep" will follow each keystroke entry).

Display:



Push the Channel 16 switch up to the "PRIORITY" position. The "7 7" in the display will be briefly interrupted once per second and replaced by "16". If a signal should appear on Channel 16, the receiver would lock on Channel 16 and remain there until the transmission is complete. Moving the Channel 16 switch to the "CHAN 16" position puts the unit in the MANUAL mode on Channel 16. The keyboard is inoperative while the "CHAN 16" switch is in this position.

6. Most areas are served by a National Weather Service transmitter. Enter the weather channel serving your area (WX 1, WX 2, WX 3 or WX 4) by using a two key stroke entry. Since these weather stations transmit continuously, you should find activity right away.

Example:

PRESS



(NOTE: If you don't know the local channel try WX 2, WX 3, or WX 4 until a signal is received)

A "beep" tone will be heard following each entry. The display will show the weather channel you have selected by either a 1, 2, 3 or 4. The yellow LED located to the right of WX will indicate that you have selected a weather channel. If the Direction Finder is operative, the LED'S will stop circling and indicate the direction of the weather station transmitter.

Note: If an incorrect weather channel is entered, the far right channel LED (the units place) will flash rapidly until a correct channel is entered.

If you do not get proper results after performing the above checks, refer to the Preparation for Use section to be sure all connections have been made properly.

## MANUAL OPERATION

The purpose of the manual mode is to be able to enter any channel at random in order to hear activity. A special feature of the NC7100 allows manual entry of any authorized channel by simply touching the channel number. Once that channel is selected, the unit is automatically in the manual mode for continuous monitoring. Whether you are in the scan mode, list mode or receiving a signal on any channel (including weather 1-4), you may select another channel of your choice by a simple 2 key-stroke entry.

### Entering a channel

Any of the valid 55 channels you wish to enter must be done so by using a 2 keystroke entry. The LED display will show 2 places: a "tens" place and a "units" place.

#### Example: Entering Channel 2

Press:



(a "beep" tone will follow each keystroke entry). The "0" will appear in the "tens" place.

After 2 seconds, if the second digit has not been entered, the "unit" place will blink "0" to remind you to complete the channel entry.

Display:



← blinking "0".

Now, press



Display:



(If an invalid channel\* entry is made, both digits will flash. To correct this, simply enter another channel number)

\* An invalid channel is any channel between 29-59 and 89-99.

The unit is now in the manual mode on channel 2. Any other channel may be selected in the same manner. Remember: You do not need to press "MANUAL" to change a channel.

**Using the Manual Key**—The purpose of the "MANUAL" key is to place the unit in manual on a particular channel for continuous monitoring.

**Example 1:** When a signal is received (squellch opens) on a desired channel, the "MANUAL" key can be used to put the unit in manual on that channel. Now you can wait for additional

incoming calls on that channel.

**Example 2:** When in the "SCAN" or "LIST" modes, you may also select manual operation by pressing "MANUAL". The unit will stop on a channel and identify it in the display. If it did not stop on the desired channel, simply select the channel you want using a 2 keystroke entry. Resume SCANNING or LISTING by pressing the appropriate key. (SCAN and LIST are described on pages 10 & 12).

**Channel 16 Switch**—With the CHAN 16 switch in the CHAN 16 position, the unit is locked in MANUAL on that channel. The display will show channel 16.

**Note:** The keyboard is inoperative while locked on Channel 16.

If the unit was in MANUAL on another channel prior to turning the Channel 16 switch to the CHAN 16 position, the unit will automatically revert back to that channel when the Channel 16 switch is turned OFF.

**Application:** This allows the operator a simple method of switching between any working channel and Channel 16 through the use of the CHAN 16 switch.

## SCAN

Selecting the SCAN function allows the unit to step through 2 or more channels looking for activity. Any or all of the available marine channels (55) can be scanned if desired. The channels will be scan monitored at a rate of about 10 per second or all 55 in about 5 seconds.

There are 3 ways to SCAN desired channels:

1. Using the "FILL" key to scan all 55 channels.
2. Using the "FILL" key to enter all 55 channels and the "DELETE" key to remove those channels not desired.
3. Using the "EMPTY" and "ENTER" keys to build your own set of channels.

**NOTE:** You cannot include WX 1, WX 2, WX 3, or WX 4 in the SCAN mode.

### Method # 1

To enter all 55 VHF Marine channels, simply touch



Now, all channels (1-28 and 60-88) are entered in the operating memory. To confirm that all 55 channels are indeed entered, press LIST. Each Channel will be displayed in numerical order beginning with:



The channels will be reviewed at the rate of about 2 channels per second. The yellow LED next to SCAN in the display will blink for each channel in the list.

Now to scan all 55 channels, press



Each channel in the operating memory will be sampled until a signal is received. The unit will stop scanning and the channel will appear in the display.

Example: Squelch opens on Channel 26:

Display:



At the conclusion of the message, the unit will resume scanning automatically. If the unit stops on a channel and noise is heard, squelch may be set too far to the right. Turn the squelch knob counterclockwise until normal scanning resumes.

#### Method #2

Use the FILL key to enter all VHF marine channels into the operating memory. Remove those channels you don't want by pressing the channel number using a 2 keystroke entry followed by "DELETE".

Example: You wish to delete channels 6 and 20.

PRESS   (Channel 6 will appear in the display)

Then, 

If the unit is in the scan or list modes, it will revert to scanning or listing the remaining channels each time "DELETE" is pressed.



PRESS

2

0

DELETE

Channels 6 and 20 have now been removed from the original list of 55. Any other channels you wish to remove can be deleted in the same manner. To confirm that channels 6 and 20 have indeed been removed, press:

LIST

The unit will begin with channel 01 and display each channel remaining in the operating memory, skipping channels 6 and 20. The SCAN LED will flash each time a channel number is displayed during LIST.

NOTE: "LIST" only tells you what is in the operating memory.

You cannot transmit or receive while in LIST.

When you have trimmed the channels in the operating memory to only those you wish to scan, press SCAN. The unit will sample each channel in the memory until a signal is received.

NOTE: You may replace the deleted channels at any time by pressing:

FILL

### Method #3

Start building your own personal set of channels by pressing EMPTY. Now all 55 channels are deleted from the operating memory. To confirm this, press SCAN. The LED next to SCAN in the display will come on and remain lit indicating no channels are in the memory.

You can now enter those channels you wish to have in your personal set. Press the channel number using a 2 keystroke entry followed by "ENTER".

Example: If you want your personal set of channels to be 4, 16, and 27,

Press: **0** **4** (channel 4 will appear in the display.)

Then,

ENTER

**NOTE:** If the unit is in the scan or list modes, it will revert to scanning or listing the channels as you enter them each time ENTER is pressed.

Then, **1** **6** **ENTER** followed by **2** **7** **ENTER**

To verify that your personal set of channels contains only channels 4, 16, and 27, press:

**LIST**

The SCAN LED will flash each time a channel number is displayed during LIST. **NOTE:** LIST only tells you what is in the operating memory. You cannot receive while in LIST. The unit will begin with the lowest channel number and display each one in numerical order. After the channel with the highest number has been displayed, the unit will return to the lowest number and begin again.

If you are satisfied with this set of channels, press:

**SCAN**

The unit will now sample each channel in your personal set until a signal is received.

**NOTE:** You may add to your set of channels at any time by pressing the channel number using a 2 keystroke entry followed by ENTER. You may also re-enter all 55 channels by pressing FILL. The unit will resume scanning automatically.

While in the LIST or SCAN modes, additional channels can be added or deleted by following the "ENTER" or DELETE" steps already given. If a channel is ENTERED or DELETED during LIST, the unit will continue listing the channels beginning with the next channel in numerical order.

### **SAVE, RECALL**

It is important to note that although your NC7100 is capable of scanning all the available 55 VHF marine channels, only a few will actually be active in a given area. Aside from the National Weather Service channel,

distress channels 16, the local coast guard and a couple more, probably won't find many other active channels. For this reason, the NC7100 has a special SAVE MEMORY feature that allows you to store your local channels for automatic recall.

Once you have compiled your personal set of channels in the operating memory using one of the methods discussed in this section, push the MEMORY LOCK function switch to "UNLOCK".

Then, press:



Now push the MEMORY LOCK switch to "MEMORY LOCK." These channels are now in the SAVE MEMORY. They will be available whenever you need them.

**IMPORTANT:** The memory can be retained only if a good 9 volt transistor battery has been installed (see page 5).

Now, if power should become disconnected, the unit turned off or even removed from the boat, those channels will remain locked in the SAVE MEMORY and be available to the operator automatically as desired. Just turn the unit on and you're ready to go. The channels you saved are now transferred to the operating memory. To verify this, press:



Your set of channels will be displayed in numerical order. You can now scan those channels by pressing:



With this unique Polaris feature, you don't have to re-enter your local channels each time you operate your NC7100.

The operating memory may be edited at any time by:

- A. Entering additional channels.
- B. Deleting existing channels.
- C. Clearing all channels with the "EMPTY" key and building a new set.
- D. Put all 55 channels back in through use of the "FILL" key.

Your personal set of channels can be recalled at any time by pressing "RECALL". Now the operating memory consists only of these channels that were in the SAVE memory.

## CHANNEL 16

PRIORITY



OFF

CHAN 16

In case you wish to use the calling channel 16 quickly, all you have to do is push the channel 16 switch to the CHAN 16 position. This automatically puts the unit in MANUAL on channel 16. You can now use channel 16 for receiving without interruption. Moving the channel 16 select switch back to off, returns the unit to whatever channel it was on previously.

## PRIORITY

PRIORITY



OFF

CHAN 16

The CHAN 16 switch is also used for selecting the PRIORITY feature. After setting the CHAN 16 switch to PRIORITY, Channel 16 will be monitored at regular intervals (about once per second) checking for activity. If a signal appears on Channel 16, the receiver will stop scanning or interrupt any transmission in progress, automatically go to Channel 16 and broadcast the message. At the conclusion of the transmission on 16, it will return to the other channel it was on or go on scanning.

## U.S./INT OPERATION

The channel frequencies used in International Marine Communications are not all the same as the channel frequencies used in the United States, though they share the same channel NUMBERS (see US/INT frequency list, page 19). The US/INT switch allows selection of the correct channel frequencies for the desired area of operation.

## DIRECTION FINDER

The revolutionary Regency Polaris direction finder, together with the specially designed dipole antenna, combine to determine direction of incoming signals with unbelievable ease and accuracy.

To operate the Direction Finder, turn the switch to the ON position.

ON



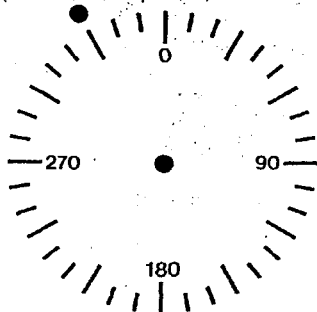
OFF

HOLD

Before operating the Direction Finder, be sure the DF antenna has been properly aligned so that a reading indicates the bow of the vessel. (See page 5).

The 36 LED's should begin circling as described on page 4. When a transmission is received (squench opens), the circling will stop. The center LED will light as well as the LED pointing to the direction of the incoming signal.

Sample Display:



The LED display will also indicate the channel on which the incoming signal is located.

After the signal disappears, the yellow LED will continue to indicate direction for approximately 2 seconds before it resumes circling.

**NOTE:** When a signal is received while the direction finder is activated, a low 1200 Hz tone can be heard in the background. This is another indication that the Direction Finder is operating.

In some cases, you may not have a chance to observe the direction of an incoming signal before squench closes (LED's resume circling). To preclude this, the NC7100 includes a Direction Finder HOLD feature. Select DF HOLD by pushing the DF/ON-OFF/HOLD switch to HOLD.

When a signal is received, the Direction Finder display will indicate the direction. When the transmission ends, the center LED will disappear but the outer LED will remain lighted to indicate direction until another key is selected or the Direction Finder switch is turned to another position. This will reset the hold feature and the circling will continue once more.

The HOLD feature is normally used to remember the particular direction of a signal while steering in the direction of that received signal. The operator can put that channel on MANUAL, get updated direction information from subsequent transmissions, and navigate directly toward any desired transmitter.

## WEATHER CHANNELS

The National Oceanic Atmospheric Administration (NOAA) broadcasts continuous weather information via transmitters throughout the U.S. 24 hours a day. Three frequencies are used in the U.S.:

WX 1—162.55

WX 2—162.400

WX 3—162.475

Canadian Weather can be monitored on:

WX 4—161.650

Your NC7200 is capable of receiving all 4 weather frequencies using a simple 2 keystroke entry.

Example: Selecting WX 1

PRESS;



A "1" will appear in the digital display while the yellow LED next to "WX" will also come on.

If WX 1 is the frequency used in your area, you should hear broadcasts immediately. If not, select WX 2, WX 3 or WX 4 in the same manner until a weather broadcast is found.

**NOTE:** If a weather channel other than those listed above is selected, the channel display will flash rapidly until a valid channel is entered.

If the Direction Finder has been activated, the LED will point to the direction of the weather station being monitored.

Channel 16 may be monitored while listening to a weather station by setting the CHAN 16 switch to PRIORITY.

**NOTE:** The digital display as well as the audio will be interrupted at regular intervals as channel 16 is sampled.

## DAY/NIGHT OPERATION



The Day-Night switch controls the brightness of the display and illumination of the keyboard. In the "DAY" position, both digital and DF display lights are at maximum brightness and the keyboard is not lighted. In the "NIGHT" position, the brightness of both the displays is reduced and the keyboard is lighted.

# NC7100

## SPECIFICATIONS

GENERAL	RECEIVER
<b>Dimensions</b> <b>(LxWxH)</b> ..... 11.1x11.2x3.6	<b>Channels</b> ..... 75
<b>Weight</b> ..... 11 lb. 6 oz.	<b>Sensitivity (max.)</b> 20 db <b>Quieting</b> ..... 35 $\mu$ V 12 db Sinad ..... 25 $\mu$ V
<b>Temperature</b> <b>Range: °C</b> ..... -20 to +50	<b>EIA</b>
<b>Power</b> ..... 13.6 VDC	<b>Selectivity</b> ..... 70db
<b>Standby</b> ..... 1A	<b>Intermodulation</b> ..... 70db
<b>Stability</b> ..... $\pm .001\%$	<b>Spurious &amp; Image Rejection</b> ..... 70db
	<b>Audio Output</b> ..... 5W @ 10% distortion 3.2 ohm
	<b>Modulation</b> ..... $\pm 7.5$ KHz <b>Acceptance</b>

# U.S./INTERNATIONAL FREQUENCY LIST

		USA		INTERNATIONAL				USA		INTERNATIONAL	
CHANNEL		TRANSMIT	RECEIVE	TRANSMIT	RECEIVE	CHANNEL		TRANSMIT	RECEIVE	TRANSMIT	RECEIVE
00	-----	156.000	-----	156.000	-----	62	156.125	160.725	156.125	160.725	-----
01	156.050	160.650	-----	156.050	160.650	63	156.175	160.775	156.175	160.775	-----
02	156.100	160.700	-----	156.100	160.700	64	156.225	160.825	156.225	160.825	-----
03	156.150	160.750	-----	156.150	160.750	65	156.275	160.875	156.275	160.875	-----
04	156.200	160.800	-----	156.200	160.800	66	156.325	160.925	156.325	160.925	-----
05	156.250	160.850	-----	156.250	160.850	67	156.375	160.975	156.375	160.975	-----
06	156.300	160.900	-----	156.300	160.900	68	156.425	161.025	156.425	161.025	-----
07	156.350	160.950	-----	156.350	160.950	69	156.475	161.075	156.475	161.075	-----
08	156.400	161.000	-----	156.400	161.000	70	156.525	161.125	156.525	161.125	-----
09	156.450	161.050	-----	156.450	161.050	71	156.575	161.175	156.575	161.175	-----
10	156.500	161.100	-----	156.500	161.100	72	156.625	161.225	156.625	161.225	-----
11	156.550	161.150	-----	156.550	161.150	73	156.675	161.275	156.675	161.275	-----
12	156.600	161.200	-----	156.600	161.200	74	156.725	161.325	156.725	161.325	-----
13	156.650	161.250	-----	156.650	161.250	75	-----	156.775	-----	156.775	-----
14	156.700	161.300	-----	156.700	161.300	76	-----	156.825	-----	156.825	-----
15	-----	156.750	-----	156.750	-----	77	156.875	161.375	156.875	161.375	-----
16	156.800	161.400	-----	156.800	161.400	78	156.925	161.425	156.925	161.425	-----
17	156.850	161.450	-----	156.850	161.450	79	156.975	161.475	156.975	161.475	-----
18	156.900	161.500	-----	156.900	161.500	80	157.025	161.525	157.025	161.525	-----
19	156.950	161.550	-----	156.950	161.550	81	157.075	161.575	157.075	161.575	-----
20	157.000	161.600	-----	157.000	161.600	82	157.125	161.625	157.125	161.625	-----
21	157.050	161.650	-----	157.050	161.650	83	157.175	161.675	157.175	161.675	-----
22	157.100	161.700	-----	157.100	161.700	84	157.225	161.725	157.225	161.725	-----
23	157.150	161.750	-----	157.150	161.750	85	157.275	161.775	157.275	161.775	-----
24	157.200	161.800	-----	157.200	161.800	86	157.325	161.825	157.325	161.825	-----
25	157.250	161.850	-----	157.250	161.850	87	157.375	161.875	157.375	161.875	-----
26	157.300	161.900	-----	157.300	161.900	88	157.425	161.925	157.425	161.925	-----
27	157.350	161.950	-----	157.350	161.950	89	-----	157.475	-----	157.475	-----
28	157.400	162.000	-----	157.400	162.000	WX1	-----	162.550	-----	162.550	-----
29	-----	157.450	-----	157.450	-----	WX2	-----	162.400	-----	162.400	-----
60	156.025	160.625	-----	156.025	160.625	WX3	-----	162.475	-----	162.475	-----
61	156.075	160.675	-----	156.075	160.675	WX4	-----	161.650	-----	161.650	-----



