PRO-2020

PLL SYNTHESIZED

VHF/UHF AM/FM RECEIVER

Catalog Number: 20-112

Manual provided by G.E. Taylor, scanned by L.P. Glaister VE7IT

CUSTOM MANUFACTURED FOR RADIO SHACK A DIVISION OF TANDY CORPORATION
GENERAL OPERATION OUTLINE

Turn Power SW ON
Automatically set to SCAN
mode and start scanning when
the SQ is on.

Press **MANUAL**.
When **MANUAL** is pressed
again the channel advances.
To select channel 1 thru 20,
enter number (via key board)
and press **MANUAL**.

Press **PROGRAM** to set to
program mode.

Program the desired fre-
quency in each channel as
follows:

Key-in the desired frequency
with numeral keys.

Press **ENT** to memorize the
frequency.
If wrong frequency (out of
band) is entered, display shows 0 0 0 0 0 .
Press **CLEAR** to clear.

Press **PROGRAM**.
Advances to next channel,
key-in the frequency and
press **ENT**; repeat to
memorize desired frequencies,
one by one.

Key-in search frequency as
follows:

Press **LIMIT** and key-in
lower frequency with
numeral keys.

Press **ENT**.

Press **LIMIT** and key-in
upper frequency.

Press **ENT**.

Press **A** to search from lower
frequency. Press **V** to search
from upper frequency.
Squelch must be on.

Press **PRIORITY** ; if
SQUELCH is ON, starts pri-
ority function.
If SQUELCH is OFF, set to
the priority channel.

Press **PRIORITY** to clear
priority.
DISASSEMBLY DIAGRAM

Step 1: Remove two bracket screws A and the bracket B.
Step 2: Remove four screws C two from each side of the Cabinet.
Step 3: Remove two screws D from back of cabinet.
Step 4: Open the cabinet. Use care not to damage leads of speaker installed on the cabinet.
ALIGNMENT AND TEST POINT POSITIONS

ALIGNMENT PREPARATION

Test equipment required
1. Oscilloscope (0 ~ 500 kHz, 0 ~ 50 MHz)
2. AC VTVM
3. DC VTVM
4. Frequency Counter (60 MHz)
5. 8 ohm dummy load
6. Slow Sweep Generator with variable marker (10.7 MHz)
7. VHF Sweep Generator with variable marker
   (30 ~ 50 MHz, 86 ~ 88 MHz, 108 ~ 174 MHz)
8. UHF Sweep Generator with variable marker
   (410 ~ 512 MHz)
9. FM Signal Generator (30 ~ 50 MHz, 68 ~ 88 MHz,
   138 ~ 174 MHz, 410 ~ 512 MHz)
10. AM Signal Generator (108 ~ 136 MHz)

NOTE 1: *Use non-metallic tuning tools.*
   The test equipment and Receiver should be warmed up at least 10 minutes before proceeding with alignment.
   Input signal from the Generator should be kept as low as possible and still obtain usable output.

NOTE 2: *A 9-volt battery is required to hold the memory when AC is disconnected. Always be sure the unit is loaded with
a fresh 9-volt battery or the pre-programmed channels will be lost (and will have to be re-programmed).*

NOTE 3: *For servicing VHF Mid band of European/Australian models, see Appendix on pages 41 and 42.*
REFERENCE FREQUENCY OSC ALIGNMENT

Step 1: Connect Frequency Counter to TP1 and ground. Connect the ground first to prevent IC-8 latch-up.
Step 2: Adjust TC-1 so that the frequency is 6.40000 MHz ±0 Hz.

NOTE 1: If 6.4 MHz fails to oscillate, it may due to IC-8 latch-up.
Unplug the power connector momentarily to turn power supply completely off.

IF SECTION ALIGNMENT

Step 1: Connect instruments as shown below.

Step 2: Adjust T105 for maximum output so that the 455 kHz marker is in the center of the discriminator curve and for best linearity as shown above.
During Alignment, maintain Sweep Generator output at the lowest level possible to prevent overloading.

VCO ALIGNMENT

VHF LO BAND

Step 1: Connect a DC VTVM to TP-104 and ground.
Step 2: Program CH1, 2 and 3 as follows:
CH1 (30 MHz), CH2 (40 MHz), CH3 (50 MHz).
Step 3: Select Channel 3 (50 MHz) and adjust TC-101 for 9.0V on the DC VTVM.
Step 4: Select Channel 1 (30 MHz) and adjust T103 for 1.0V on the DC VTVM.
Step 5: Repeat steps 3 and 4 until no improvement is observed. The DC VTVM should show as below.

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Voltage at TP104</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 MHz</td>
<td>1.0V</td>
</tr>
<tr>
<td>40 MHz</td>
<td>3.4 ±0.3V</td>
</tr>
<tr>
<td>50 MHz</td>
<td>9.0V</td>
</tr>
</tbody>
</table>

VHF HI BAND AND AIRCRAFT

Step 1: Connect a DC VTVM to TP104 and ground.
Step 2: Program CH1, 2, 3, 4, 5 and 6 as follows.
CH1 (108 MHz), CH2 (120 MHz), CH3 (136 MHz), CH4 (138 MHz), CH5 (160 MHz), CH6 (174 MHz).
Step 3: Select Channel 6 (174 MHz) and adjust TC102 for 8.0V on the DC VTVM.
Step 4: Select Channel 1 (108 MHz) and adjust L107 for 1.0V on the DC VTVM.
Step 5: Repeat steps 3 and 4 until no improvement is observed. The DC VTVM should show as below.

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Voltage at TP104</th>
</tr>
</thead>
<tbody>
<tr>
<td>108 MHz</td>
<td>1.0V</td>
</tr>
<tr>
<td>120 MHz</td>
<td>2.1 ± 0.3V</td>
</tr>
<tr>
<td>136 MHz</td>
<td>3.6 ± 0.3V</td>
</tr>
<tr>
<td>138 MHz</td>
<td>1.8 ± 0.3V</td>
</tr>
<tr>
<td>160 MHz</td>
<td>3.9 ± 0.3V</td>
</tr>
<tr>
<td>174 MHz</td>
<td>8.0V</td>
</tr>
</tbody>
</table>
UHF BAND
Step 1: Connect a DC VTVM to TP-104 and ground.
Step 2: Program CH1, 2 and 3 as follows:
   Ch1 (410 MHz), CH2 (430 MHz), CH3 (512 MHz).
Step 3: Select Channel 3 (512 MHz) and adjust TC-106 for 9.0V on the DC VTVM.
Step 4: Select Channel 1 (410 MHz) and adjust L111 for 1.0V on the DC VTVM.
Step 5: Repeat steps 3 and 4 until no improvement is observed. The DC VTVM should show as below.
   410 MHz Voltage at TP-104 1.0V
   430 MHz Voltage at TP-104 1.8 ± 0.3V
   512 MHz Voltage at TP-104 9.0V

RF AMP ALIGNMENT

VHF LO BAND
Step 1: Connect instruments as shown below.

Step 2: Program 30 MHz (CH1), 40 MHz (CH2) and 50 MHz (CH3).
Step 3: Select Channel 2 (40 MHz) and adjust T101 and T102 for maximum RF waveform.
Step 4: Check Channels 1 ~ 3 for the maximum RF waveform. A slight deviation (as shown below) is acceptable.

VHF HI AND AIRCRAFT
Step 1: Connect instruments as shown below.
Step 2: Program 108 MHz (CH1), 120 MHz (CH2), 136 MHz (CH3), 138 MHz (CH4), 160 MHz (CH5) and 174 MHz (CH6).
Step 3: Select Channel 1 (108 MHz) and adjust L104 and L106 for maximum RF waveform.
Step 4: Select Channel 5 (160 MHz) and adjust L103 and L105 for maximum RF waveform.
Step 5: Repeat steps 3 and 4 to obtain the maximum RF waveform for each channel.
Step 6: Check Channels 1 ~ 6 for the maximum RF waveform at each frequency marker. A slight deviation (as shown below) is acceptable.

UHF BAND
Step 1: Connect instruments as shown below.

Step 2: Program 410 MHz (CH1), 430 MHz (CH2) and 512 MHz (CH3).
Step 3: Select Channel 2 (430 MHz) and adjust TC-103, TC-104, and TC-105 for maximum RF waveform.
Step 4: Select Channel 3 (512 MHz) and adjust TC-107 for maximum RF waveform.
Step 5: Check Cannels 1 ~ 3 for the maximum RF waveform at each frequency marker. A slight deviation (as shown below) is acceptable.
OVERALL ALIGNMENT AND SENSITIVITY MEASUREMENT

Step 1: Connect Signal Generator (SSG) to ANTenna jack and AC VTVM to EXT, SPKR Jack.
Step 2: Turn SQUELCH fully counterclockwise. Set for reception of the channels noted in the following chart. Set the SSG to the center of each band.

<table>
<thead>
<tr>
<th>CH</th>
<th>BAND</th>
<th>FREQ.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>VHF LO (MID)</td>
<td>40 MHz (78 MHz)</td>
</tr>
<tr>
<td>2</td>
<td>VHF HI</td>
<td>160 MHz</td>
</tr>
<tr>
<td>3</td>
<td>UHF</td>
<td>512 MHz</td>
</tr>
<tr>
<td>4</td>
<td>AIRCRAFT</td>
<td>120 MHz</td>
</tr>
</tbody>
</table>

Step 3: Set the Signal Generator frequency to 512 MHz (channel 3). Readjust TC-107 for maximum sensitivity.
Step 4: Set the Signal Generator frequency to 120 MHz (channel 4). Adjust T104, T106 and T107 for maximum sensitivity.
Step 5: For each frequency/channel, set Signal Generator to each frequency (FM: 3 kHz deviation, AM: 60% modulation). Set VOLUME control for 0 dB (0.775 V) reading on the VTVM.
Step 6: Turn off the modulation and measure the (S + N)/N ratio.

ZEROMATIC FUNCTION AND HOW TO CHECK IT

* Zeromatic functions when OUTPUT 1 is in "H" level.

<table>
<thead>
<tr>
<th>e₁</th>
<th>OUTPUT 1 (Pin No. 2)</th>
<th>OUTPUT 1 (Pin No. 4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>H</td>
<td>L</td>
</tr>
<tr>
<td>H</td>
<td>L</td>
<td>H</td>
</tr>
</tbody>
</table>

To adjust e₁ voltage, receive signal in Manual mode, and set T105 to get half supply voltage (IC101, 4 pin). It is convenient to use the National Weather Service Signal for the adjustment.
In the event Zeromatic does not function right, refer to "REFERENCE FREQUENCY OSC ALIGNMENT" and check 6.4 MHz, and adjust T105 again.
RESET TIMING (IC-1)

NOTE:
Pin 31 of IC-1 is the RESET terminal which functions at L level. It reverts to H level 2ms after Pin 42 VDD.

CPU CLOCK OSCILLATION WAVEFORM (IC-1)

NOTE:
This is the basic waveform of CPU (IC-1). Ceramic Resonator (X-2) generates 400 kHz for about 2.5μs

IC-3 INPUT/OUTPUT WAVEFORM

NOTE:
Waveform at Pin No. 5 is CPU (IC-1) interrupt signal. Must have above waveform or the CPU program malfunctions.
IC-4 INPUT/OUTPUT TIME CHART (150 MHz displayed, in Program Mode)

Pin No

1

5V

0V

3

5V

0V

INPUT

4

5V

0V

5

5V

0V

6

5V

0V

15

5V

0V

-26V

14

5V

0V

-26V

13

5V

0V

-26V

12

5V

0V

-26V

OUTPUT

11

5V

0V

-26V

10

5V

0V

-26V

9

-26V

0.12 ms

0.3 ms

1.3 ms

2.4 ms

1.2 ms
IC-6 INPUT/OUTPUT TIME CHART  (150 MHz displayed, in Program Mode)
PLL CLOCK AND DATA INPUT WAVEFORMS (IC-8)

*Measured during SCAN: 150 MHz displayed on CH1, CH2 ~ 20 are locked out.
MEMORY CHECK

POWER ON

Apply 150 MHz to CH1

Unplug AC/DC cords

Does Pin No. 22 of IC-2 show 2 ~ 6 Volts

NO

Defective D126 ~ 129 or battery

YES

Plug in AC/DC cords

Is 150 MHz displayed on CH1?

NO

Apply 150 MHz to CH1

Is 150 MHz reception OK?

NO

Defective IC-8

YES

Press ENT KEY sequentially

Is a pulse existing at each Pin No. 9, 11, 13, 15, 19 and 20 of IC-2

NO

Defective CPU (IC-1), IC-9 and/or associated circuitry

YES

150 MHz enters CH1 ~ 5 but is locked out in other CH

Press SCAN to turn SO on

Memory circuitry is OK

Is a pulse existing at Pin No. 1, 2, 3, and 4 of IC-1

Defective IC-2 and/or associated circuitry

Defective CPU (IC-1) and/or IC-2
**RECEPTION CHECK**

**Table-1**

<table>
<thead>
<tr>
<th>IC-10 Pin No.</th>
<th>11</th>
<th>8</th>
<th>3</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>FREQ. BAND</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LOW or MID</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>AIRCRAFT</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>HIGH</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>UHF</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

**NOTE:** 1 = 7.6V  
0 = 0V

1. **Power on**
2. **Does DISPLAY light properly?**  
   - **YES**
   - **NO**
   - **Does SQ function and scan when SQ is ON?**
     - **YES**
     - **NO**
     - **Does Key-in work properly?**
       - **YES**
       - **NO**
       - **Does the Unit produce NOISE when Volume Control turned clockwise? (SO: counterclockwise)?**
         - **YES**
         - **NO**
         - **Is reception OK when correct frequencies are entered?**
           - **YES**
           - **NO**
           - **Does Memory function work OK?**
             - **YES**
             - **END**
             - **NO**
             - **Faulty connection between Linear and Logic PCBs.**

3. **Is Backup battery OK?**
4. **Is Band switch (which consists of IC-8, 10) OK?**
5. **Refer to Table-1:**
6. **Is Band switch (which consists of Q113 ~ 117) OK?**
7. **Is IC-1 OK, and reset properly?**
8. **Is IC-6 circuitry OK?**
9. **Is RESET circuitry consists of Q7, IC-9 OK?**
10. **Is IC-1 OK?**
11. **Is IC-2, and/or IC-9 OK?**
12. **Is PLL circuitry (which consists of IC-7, 8) OK?**
13. **Is Mute circuitry (consists of IC-102, Q112) OK?**
14. **Is Audio Amp (which consists of Q127, IC-105) OK?**
15. **Is IC-1 OK?**
16. **Pin 33 scans at L level, and scan stops at H level.**

**Manual provided by G.E. Taylor, scanned by L.P. Glaister VE7IT**
<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Display does not light and no sound when POWER is on. Volume control: MAX. Squelch control: counterclockwise (CCW)</td>
<td>1) Faulty power cord. 2) Defective power transformer. 3) Defective power switch. 4) Defective rectifier D131 or Polarity Protector D130.</td>
</tr>
<tr>
<td>2) Display lights but no sound. Volume control: MAX. Squelch control: CCW</td>
<td>1) Defective speaker or EXT. SPKR jack. 2) Defective audio amplifier IC-105, Q128, 129 and/or associated circuit components. 3) Defective IF amplifier IC-101 and/or associated circuit components. 4) Defective functional squelch control and mute switching IC-102, 103 and/or associated circuit components.</td>
</tr>
<tr>
<td>3) Sound but display does not light. Volume control: MAX. Squelch control: CCW</td>
<td>1) Defective DC–DC converter consisting of Q6, 7, 8, D8, 9, 10, 11. 2) Defective fluorescent display tube. 3) Defective DC–DC converter Transformer (T1). 4) Defective voltage Regulator IC-107. 5) Defective CPU (IC-1) or associated circuit components.</td>
</tr>
<tr>
<td>4) Does not scan and squelch does not operate.</td>
<td>1) Defective Q119 and/or associated circuit components. 2) Defective IC-1, D119 and/or associated circuit components. 3) Defective squelch circuit consisting of IC-102, 103.</td>
</tr>
<tr>
<td>5) Does not scan but squelch operates.</td>
<td>1) Faulty connection between Linear and Logic P.C.B. 2) Defective Keyboard and/or associated circuit components. 3) Defective IC-1, and/or associated circuit components.</td>
</tr>
<tr>
<td>6) Displays incorrectly and/or unable to key in correctly.</td>
<td>1) Defective Keyboard and/or associated circuit. 2) Defective CPU (IC-1) and/or associated circuit. 3) Defective IC-4, 5, 6 and/or associated circuit.</td>
</tr>
<tr>
<td>7) Displays correctly at the time of programming, but after scanning becomes faulty.</td>
<td>1) Defective memory IC-2 and/or associated circuit. 2) Defective IC-3, 9, 10 and/or associated circuit. 3) Defective IC-1 and/or associated circuit.</td>
</tr>
<tr>
<td>8) MANUAL scan operates but AUTO scan does not operate.</td>
<td>1) All channels are skipped (lockout). 2) Squelch control is not adjusted right.</td>
</tr>
<tr>
<td>9) “Zeromatic” does not operate or holds on a drifted frequency at search operation.</td>
<td>1) Defective Q125, IC-104 in Zeromatic circuit. 2) Discriminator coil is out of adjustment. TP-105 shall have 1/2 VCC (approx. 3.0V) in normal receiving mode. 3) Is 6.4 MHz adjusted correctly?</td>
</tr>
<tr>
<td>10) All bands do not operate but display OK.</td>
<td>1) Faulty connection between Linear and Logic PCBs. 2) Defective Q8 ~ 11 in Low-pass filter. 3) Defective IC-7, 8, 9, 10 and/or associated circuit. 4) Defective D116, 117 and/or associated circuit. 5) Defective Q112 and/or associated circuit.</td>
</tr>
<tr>
<td><strong>Symptom</strong></td>
<td><strong>Possible Cause</strong></td>
</tr>
<tr>
<td>-------------</td>
<td>--------------------</td>
</tr>
</tbody>
</table>
| 11) Low (Mid) band does not operate but Air, Hi, UHF band operate. | 1) Defective Low band RF Amp, mixer and/or VCO circuit.  
2) Defective IC-9, 10, Q117 and/or associated circuit. |
| 12) Aircraft band does not operate but Low, High, UHF operate. | 1) Defective D105, 107, Q114, 115 and/or associated circuit.  
2) Defective AM IF Amp including Q120, 121, D120. |
| 13) Aircraft and High band do not operate but Low, UHF band operate. | 1) Defective Q104 ~ 106 in RF Amp mixer and/or in VCO circuit.  
2) Defective Q114 ~ 116 in band switch circuit. |
| 14) UHF band does not operate but Low Air, High band operate. | 1) Defective Q108 ~ 111 in RF Amp mixer and/or VCO circuit.  
2) Defective Q113 in band switch circuit. |
IC-104 TA7521P

IC-105 SN76007N

IC-106 HA17808P or μA7808UC
IC-107 HA17805P or μA7805UC
SEMICONDUCTOR LEAD IDENTIFICATION

A) 3SK77 (GR)(BL)

B) 2SC1923(R)(O), 2SC1815(O),(Y)(GR), 2SA495(O), 2SA1015(O),(Y), 2SC2347, 2SC732(BL), 2SC1384(R)

B) or C) 2SC535 (B)

D) 2SC1117
DIODE IDENTIFICATION AND LEAD POLARITY

A) 1S2076A

B) 1N60

C) HZ5C-2, HZ9LC-3, HZ16L-1

D) 1SS81

E) 1SS85

F) 1S1588 (or HV-80)

G) S5277B

H) 1SV89B

I) FC-54
APPENDIX for VHF-MID Band for European/Australian models

VCO ALIGNMENT
Step 1: Connect a DC VTVM to TP-104 and ground
Step 2: Program CH1, 2 and 3 as follows:
       CH1 (68 MHz), CH2 (78 MHz), CH3 (88 MHz)
Step 3: Select channel 3 (88 MHz) and adjust TC-101 for 9.0V on the DC VTVM
Step 4: Select channel 1 (68 MHz) and adjust T103 for 1.0V on the DC VTVM
Step 5: Repeat steps 3 and 4 until no improvement is observed.
The DC VTVM should show as below.
       68 MHz  Voltage of TP-104  1.0V
       78 MHz  Voltage of TP-104  3.4V ±0.3V
       88 MHz  Voltage of TP-104  9.0V

RF AMP ALIGNMENT
Step 1: Connect instruments as shown below.

Step 2: Program 68 MHz (CH1), 78 MHz (CH2), 88 MHz (CH3).
Step 3: Select Channel 1 (68 MHz) and adjust T101 and T102 for maximum RF waveform.
Step 4: Check the Channels 1 ~ 3 one by one for maximum RF waveform.
       Slight deviation as shown below is tolerable.

PARTS LIST REVISION

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Value</th>
<th>Voltage (V)</th>
<th>Tolerance (%)</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>C102</td>
<td>33pF</td>
<td>50</td>
<td>±10</td>
<td>Ceramic</td>
</tr>
<tr>
<td>C109</td>
<td>33pF</td>
<td>50</td>
<td>±10</td>
<td>Ceramic</td>
</tr>
<tr>
<td>C114</td>
<td>47pF</td>
<td>50</td>
<td>±10</td>
<td>Ceramic</td>
</tr>
<tr>
<td>C116</td>
<td>33pF</td>
<td>50</td>
<td>±10</td>
<td>Ceramic</td>
</tr>
<tr>
<td>C117</td>
<td>5pF</td>
<td>50</td>
<td>±0.5pF</td>
<td>Ceramic</td>
</tr>
<tr>
<td>C250</td>
<td>10pF</td>
<td>50</td>
<td>±0.5pF</td>
<td>Ceramic</td>
</tr>
<tr>
<td>R271</td>
<td>1.8MΩ</td>
<td>not used</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>Description</th>
<th>Substitute Type No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>D103</td>
<td>Variable capacitor</td>
<td>not used</td>
</tr>
<tr>
<td>T101</td>
<td>RF Coil</td>
<td>GR-N553</td>
</tr>
<tr>
<td>T102</td>
<td>RF Coil</td>
<td>GR-N553</td>
</tr>
<tr>
<td>T109</td>
<td>Power Transformer</td>
<td>K8862</td>
</tr>
<tr>
<td>B.T.F.</td>
<td>Trap Filter</td>
<td>20LTR-141</td>
</tr>
<tr>
<td>AC Cord</td>
<td></td>
<td>HAR Class 2</td>
</tr>
</tbody>
</table>
APPENDIX (Continued)

MID BAND RF SECTION SCHEMATIC DIAGRAM

LOGIC SECTION SCHEMATIC DIAGRAM

In mid band, pin 36 of IC-1 is wired as per dotted line.
CONTENTS

SPECIFICATIONS ........................................................................................................ 3
PRINCIPLES OF OPERATION ................................................................................. 4
DISASSEMBLY DIAGRAM ....................................................................................... 5
BLOCK DIAGRAM .................................................................................................... 6
GENERAL OPERATION OUTLINE ........................................................................... 7
ALIGNMENT
  ALIGNMENT AND TEST POINT POSITIONS .......................................................... 8
  ALIGNMENT PREPARATION ................................................................................... 8
  REFERENCE FREQUENCY OSC ALIGNMENT ....................................................... 9
  IF SECTION ALIGNMENT ................................................................................... 9
  VCO ALIGNMENT ................................................................................................ 9,10
  RF AMP ALIGNMENT .......................................................................................... 10,11
  OVERALL ALIGNMENT AND SENSITIVITY MEASUREMENT .......................... 12
ZEROMATIC FUNCTION AND HOW TO CHECK IT ............................................... 12
RESET TIMING (IC-1) ............................................................................................. 13
CPU CLOCK OSCILLATION WAVEFORM (IC-1) .................................................... 13
IC-3 INPUT/OUTPUT WAVEFORM ......................................................................... 13
IC-4 INPUT/OUTPUT TIME CHART ....................................................................... 14
IC-6 INPUT/OUTPUT TIME CHART ....................................................................... 15
PLL CLOCK AND DATA INPUT WAVEFORMS (IC-8). .......................................... 16
MEMORY CHECK .................................................................................................... 17
RECEPTION CHECK ................................................................................................. 18
WIRING DIAGRAM .................................................................................................... 19
PRINTED CIRCUIT BOARD
  LINEAR P.C. BOARD (TOP VIEW) ................................................................. 20
  LINEAR P.C. BOARD (BOTTOM VIEW) ............................................................ 21
  LOGIC P.C. BOARD (TOP VIEW) ...................................................................... 22
  LOGIC P.C. BOARD (BOTTOM VIEW) .............................................................. 23
TROUBLESHOOTING ............................................................................................... 24,25
INTEGRATED CIRCUIT LEAD IDENTIFICATION ............................................... 26 ~ 30
SEMICONDUCTOR LEAD IDENTIFICATION ....................................................... 31
DIODE IDENTIFICATION AND POLARITY ....................................................... 32
MICRO-COMPUTER (IC-1) PORT FORMAT ....................................................... 33
PARTS LIST ............................................................................................................. 34 ~ 40
APPENDIX FOR VHF-MID BAND FOR EUROPEAN/AUSTRALIAN MODELS .... 41,42
EXPLODED VIEW ................................................................................................... 43
SCHEMATIC DIAGRAM (LOGIC SECTION) ....................................................... 44,45
SCHEMATIC DIAGRAM (LINEAR SECTION) ....................................................... 46,47
### SPECIFICATIONS

<table>
<thead>
<tr>
<th>Description</th>
<th>Nominal spec.</th>
<th>Limit spec.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Frequency Coverage</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VHF LOW (* or MID)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AIRCRAFT</td>
<td>0.5 μV</td>
<td>2 μV</td>
</tr>
<tr>
<td>VHF HIGH</td>
<td>1 μV</td>
<td>3 μV</td>
</tr>
<tr>
<td>UHF</td>
<td>0.5 μV</td>
<td>2 μV</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>1 μV</td>
<td>4 μV</td>
</tr>
<tr>
<td>MOD.: 60% at 1 kHz (S + N)/N = 20 dB</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Selectivity</strong></td>
<td>±9 kHz</td>
<td>±12 kHz</td>
</tr>
<tr>
<td>-60 dB</td>
<td>±15 kHz</td>
<td>±18 kHz</td>
</tr>
<tr>
<td><strong>Spurious Rejection</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>at 40 MHz (* or 78 MHz)</td>
<td>50 dB</td>
<td>40 dB</td>
</tr>
<tr>
<td>at 120 MHz</td>
<td>50 dB</td>
<td>40 dB</td>
</tr>
<tr>
<td>at 160 MHz</td>
<td>50 dB</td>
<td>40 dB</td>
</tr>
<tr>
<td>UHF</td>
<td></td>
<td>Not specified</td>
</tr>
<tr>
<td><strong>IF Rejection</strong></td>
<td>80 dB</td>
<td>40 dB</td>
</tr>
<tr>
<td><strong>Modulation Acceptance</strong></td>
<td>±7 kHz</td>
<td>±5 kHz</td>
</tr>
<tr>
<td>(EIA RS-204-A)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Signal to Noise Ratio</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(AM: MOD. 60% at 1 kHz)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(FM: DEV. 3 kHz at 1 kHz)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>VHF LOW (* or MID)</td>
<td>45 dB</td>
<td>30 dB</td>
</tr>
<tr>
<td>AIRCRAFT</td>
<td>40 dB</td>
<td>25 dB</td>
</tr>
<tr>
<td>VHF HIGH</td>
<td>40 dB</td>
<td>25 dB</td>
</tr>
<tr>
<td>UHF</td>
<td>35 dB</td>
<td>25 dB</td>
</tr>
<tr>
<td>Residual Noise (Vol. Min.)</td>
<td>3 mV</td>
<td>5 mV</td>
</tr>
<tr>
<td><strong>Scanning Speed</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fast</td>
<td>9 channels/sec.</td>
<td>6 ~ 12 channels/sec.</td>
</tr>
<tr>
<td>Slow</td>
<td>4 channels/sec.</td>
<td>3 ~ 7 channels/sec.</td>
</tr>
<tr>
<td><strong>Search Rate</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fast</td>
<td>9 steps/sec.</td>
<td>6 ~ 12 steps/sec.</td>
</tr>
<tr>
<td>Slow</td>
<td>4 steps/sec.</td>
<td>3 ~ 7 steps/sec.</td>
</tr>
<tr>
<td><strong>Priority Sampling</strong></td>
<td>2 sec.</td>
<td>1.5 ~ 2.5 sec.</td>
</tr>
<tr>
<td><strong>Scan Delay Time</strong></td>
<td>2 sec.</td>
<td>1 ~ 3 sec.</td>
</tr>
<tr>
<td><strong>Audio Output Power (T.H.D. 10 %)</strong></td>
<td>1.5 W</td>
<td>1 W</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Channels of Operation</th>
<th>Any 20 channels in any band combination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Channel, Frequency and Mode Display</td>
<td>Direct Key entry Digital-Controlled Synthesizer, Superheterodyne</td>
</tr>
<tr>
<td>Receiving System</td>
<td>1st IF: 10.7 MHz 2nd IF: 455 kHz</td>
</tr>
<tr>
<td>Power Requirements</td>
<td>AC:120 V 60 Hz 19 W (220 ~ 240 V, 50 Hz for European/Australian)</td>
</tr>
<tr>
<td></td>
<td>DC:13.8 V 10 W</td>
</tr>
<tr>
<td>Accessory</td>
<td>Telescopic antenna and Car Mounting bracket with Screws.</td>
</tr>
</tbody>
</table>

**NOTE:** Nominal Specs represent the design specs: all units should be able to approximate these — some will exceed and some may drop slightly below these specs. Limit Specs represent the absolute worst condition which still might be considered acceptable: in no case should a unit perform to less than within any Limit Spec.

* VHF MID (68 ~ 88 MHz) range is for European and Australian Models only.