

**SERVICE  
MANUAL  
ADDENDUM**

**ASTRO-103  
TRANSCEIVER**

**MODIFICATION  
TO THE  
ASTRO-102BX  
TRANSCEIVER**



**CUBIC COMMUNICATIONS, INC.**  
*A member of the Cubic Corporation family of companies*



# CUBIC COMMUNICATIONS, INC.

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To the Service Technician:

The ASTRO-103 is an updated version of the field proven ASTRO-102BX, adding the new amateur bands designated during the 1979 World Administrative Radio Conference (WARC). The new bands are added by substitution of the bandswitch and lowpass filter assembly and by the addition of preselector and local oscillator sections corresponding to the new bands at 30, 17 and 12 meters.

In addition to the new bands, an RTTY mode has been added to the transceiver that enables the use of the optional 6 pole narrow bandwidth crystal filter while operating on the lower sideband, such as is normal in amateur radio teletype using audio frequency shift keying. Some minor changes were made in the PTO mode switching sequence in response to customer suggestions.

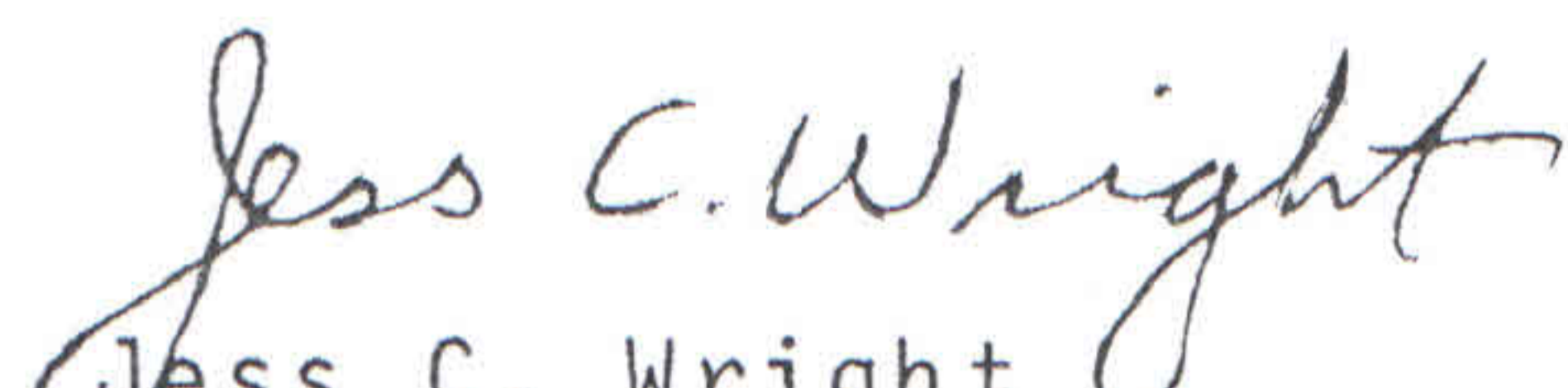
All other features of the ASTRO-102BX are incorporated into the ASTRO-103. It is possible to convert an ASTRO-102BX transceiver into an ASTRO-103 by the addition of the new boards and some minor modifications to the existing boards following the step by step procedure written for the ASTRO-103 conversion kit. You can perform this conversion for your customers by ordering the conversion kit.

This manual is written as an addendum to the ASTRO-102BX Service Manual to emphasize the similarity between the two transceivers. This manual is organized in exactly the same sequence as the ASTRO-102BX Service Manual, with only the significant differences between the two transceivers indicated in the addendum.

You will note that the Swan name has been dropped and only the Cubic Communications name has been retained. The organization remains dedicated to the goal of serving the needs of our customers and our service technicians throughout the world.

Sincerely,

CUBIC COMMUNICATIONS, INC.

  
Jess C. Wright  
President

JCW/1b

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## General

# Information

The Cubic Communications, Inc. (CCI) ASTRO-103 is similar to the Swan ASTRO-102BX and the CCI ASTRO-102BXA with the addition of the new bands at 30, 17, and 12 meters.

The old standard 2 pole narrow band crystal CW filter has been deleted and replaced with an optional 6 pole unit having a 6dB bandwidth of 400 Hz. Older model transceivers can be upgraded to use the new 6 pole narrow CW filter with the addition of an accessory circuit board. Newer model transceivers have space on the exciter circuit board to accommodate the optional filter.

The RTTY mode in the ASTRO-103 transceiver is useable only if the optional CW narrow filter is installed. This mode is basically LSB narrow with the position of the 400 Hz bandwidth filter controlled by the passband tuning control.

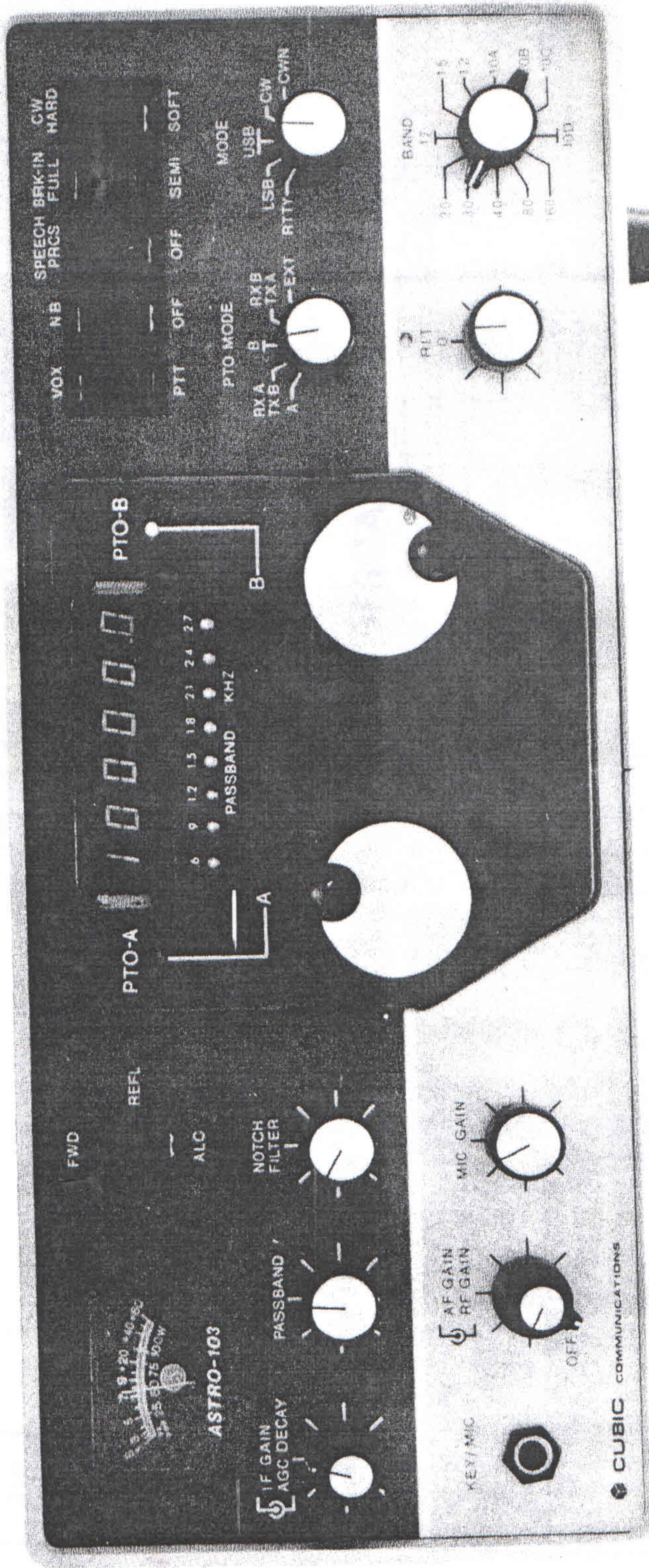


FIGURE 5-1

# Specifications

## GENERAL

### Frequency Coverage

For the ASTRO-103, add the following bands:

|          |               |
|----------|---------------|
| 30M..... | 10.0-10.5 MHz |
| 17M..... | 18.0-18.5 MHz |
| 12M..... | 24.5-25.0 MHz |

### Modes of Operation:

For the ASTRO-103, add the following:

CW Narrow with the optional filter  
RTTY (LSB Narrow) with the optional filter

### Rear Panel:

For the ASTRO-103, add the following:

|                             |              |
|-----------------------------|--------------|
| Separate Receiving Antenna: | RCA Jack     |
| Receiver Antenna Selector:  | Slide Switch |

## RECEIVER

### Receiver Selectivity:

For the ASTRO-103, change CWN to read:

CWN and RTTY--400 Hz bandwidth 6 pole crystal filter in series  
with 8 pole SSB filter

# Receiver Theory

|                                      |     |
|--------------------------------------|-----|
| Bandswitch and Low Pass Filters..... | 3-2 |
| Preselector.....                     | 3-2 |
| CW Narrow Filter.....                | 3-3 |

BANDSWITCH AND LOWPASS FILTER BOARD

The ASTRO-103 is similar to the ASTRO-102BX in that one of six lowpass filters is switched into the circuit in both receive and transmit conditions. The filter sections are shared on some bands, however, with the 30 and 40 meter bands utilizing one section, the 17 and 20 meter bands utilizing a second section, and the 12 and 15 meter bands sharing a third section. The component values for each filter section are somewhat modified from the values used in the ASTRO-102BX.

Receiver antenna switching is performed by relay K101 when the common or normal receive antenna selection is made on the rear panel switch added in the ASTRO-103. A second relay has been added in the ASTRO-103 to allow for use of a separate receiving antenna. The contacts on this second relay connect the antenna side of C122 (in the ASTRO-102BX schematic) to the separate receiving antenna input jack on the rear panel. The antenna selection switch on the rear panel merely selects which relay is activated by transistor Q102. The drive to shunt transistor, Q101, has been slightly modified in the ASTRO-103 to eliminate any slight delay in the opening of either relay. Otherwise the operation of this circuitry is similar in both transceivers.

The band control wafer, S103, on the bandswitch has been modified to provide additional band control lines. In order to preserve the wiring in the ASTRO-102BX transceivers being upgraded to the ASTRO-103 configuration, the control information for the three additional bands has been brought out through a separate connector for use elsewhere in the transceiver.

Refer to the schematic diagram for the lowpass filter board provided with the manual addendum for additional information.

PRESELECTOR

The preselector section in the ASTRO-103 transceiver operates in a similar fashion as the preselector section in the ASTRO-102BX. A second preselector board (Auxiliary Preselector) is mounted above the original preselector board to accommodate the three new bands with a coaxial cable interconnection between the boards. Switching of selected bands is performed by the control lines originating at S103 as before. Refer to the schematic diagrams for the Preselector and Auxiliary Preselector boards provided with this addendum.





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CWN FILTER

The 2 pole CWN filter provided with the ASTRO-102BX has been deleted in the ASTRO-103. A 6 pole filter is available as an option. On early model transceivers, the 6 pole filter is mounted on an auxiliary circuit board above the area formerly containing the 2 pole filter. Late model transceivers utilize a circuit board having provisions for drop-in mounting of the 6 pole filter.

# Transmitter Theory

All transmitter circuitry in the ASTRO-103 is identical to that in the ASTRO-102BX with the exception of the Preselector Bandpass Filters. As in the ASTRO-102BX, the identical filters are used in both receive and transmit.



# Oscillator Theory

Band Voltage Controlled Oscillators.....5-2  
Local Oscillator Mixer.....5-2

## BAND VOLTAGE CONTROLLED OSCILLATORS

The band voltage controlled oscillators in the ASTRO-103 transceiver are essentially identical to those in the ASTRO-102BX. An Auxiliary Local Oscillator board is mounted above the Local Oscillator board to provide space for the oscillators used on the added bands with a coaxial cable interconnection between the two boards to couple the oscillator output.

The programming of counters U102 and U103 is accomplished in a similar manner in the two transceivers except the programmable read only memory (PROM) U105 is modified for the ASTRO-103. Previously unused states in the PROM are programmed to the desired conditions corresponding to the new bands. Late model ASTRO-102BXA transceivers are shipped with the PROM corresponding to either the ASTRO-102BX or ASTRO-103 configurations. This part can be recognized by the CCI part number marked on the top of U105 -- if the number is 478-012 it is suitable for an ASTRO-103, if the number is 478-008 it is suitable only for an ASTRO-102BX.

Some changes are made in the steering of the band control lines as shown in the schematic diagram on page 5-2 of the ASTRO-102BX Service Manual. The diode matrix shown in this diagram is replaced with a similar matrix on the Auxiliary L.O. board with provisions for the three additional bands. The output of the matrix is then wired to U105 using a 5 wire cable.

The outputs of the D.C. Error Amplifiers are brought up to the Auxiliary L.O. board to control the oscillators. The 12 meter oscillator utilizes the 10 meter error line while the 30 and 17 meter oscillators utilize the 160-15 meter error line.

The schematic diagrams for the Auxiliary L.O. and the L.O. board with the ASTRO-103 modification are included with this manual. Refer to these schematic diagrams for additional details.

## LOCAL OSCILLATOR MIXER

The Auxiliary L.O. board also contains a set of three bandpass filters to accommodate the L.O. signal for the three new bands. The circuits are similar to those on the L.O. board with circuit selection performed by the band control lines.

In addition to the band VCOs, diode matrix and the bandpass filters, the Auxiliary L.O. board contains circuitry and connectors to properly interconnect all modules utilizing the band control signals. Refer to the schematic diagrams and main interconnect diagram for complete details.

## Ancillary Circuits

### FREQUENCY COUNTER

The frequency counter circuitry in the ASTRO-103 is modified to accommodate primarily the 30 meter band. As can be seen from the description in the ASTRO-102BX Service Manual, the most significant digit in the frequency display is controlled by external gating operating on the band control lines. The control wiring to the frequency counter is intercepted on the Auxiliary L.O. board in order to add the additional gating for the 30, 17, and 12 meter bands.

The problem with the 30 meter band, however, is that the most significant digit would be a 1 above 10 MHz and a 0 below 10 MHz. An external gating signal could not perform this function. An Auxiliary Counter circuit board is thus installed internally to the counter enclosure to sense the above or below 10 MHz condition. The most significant digit is thus controlled correctly on the 30 and 20 meter bands. All other bands have the most significant digit controlled directly by the band control lines.

## Servicing Hints

The ASTRO-103 represents an addition to the capability and features of the ASTRO-102BX but utilizes the same type of circuitry and components. Consequently, no change in the text of this section is required. The following additional note, however, can be applied to both the ASTRO-102BX and the ASTRO-103.

### PASSBAND TUNING

An analysis of the filter response curves shown in the passband tuning section in the ASTRO-102BX Service Manual will show that one edge of the overall response curve will remain fixed in frequency while the opposite edge can be varied by using the PASSBAND TUNING control. A clockwise rotation of the control from the mid position will hold the upper edge fixed while varying the lower edge. Conversely, a counter-clockwise rotation of the control will hold the lower edge fixed while varying the upper edge. In this manner, the overall bandwidth can be varied and can be used to eliminate interference near one corner or the other of the filter response curve.

A comparison with amateur transceivers from other manufacturers will sometimes reveal that the function called passband tuning by some manufacturers would be better described as IF shift. The function is sometimes known by that name. The IF shift function merely moves the same filter bandwidth over a small range of frequencies. Although an interfering signal occurring near one edge of the normal response band could be eliminated with this method, the shift of the overall band could introduce interference from signals near the opposite edge. Note that the passband tuning function, as implemented in the ASTRO-102BX and ASTRO-103 transceivers, requires a second crystal filter, two mixers and a front panel controllable oscillator, while the much less effective IF shift function only requires a method of varying the beat frequency oscillator and tuning oscillator together from a front panel control.



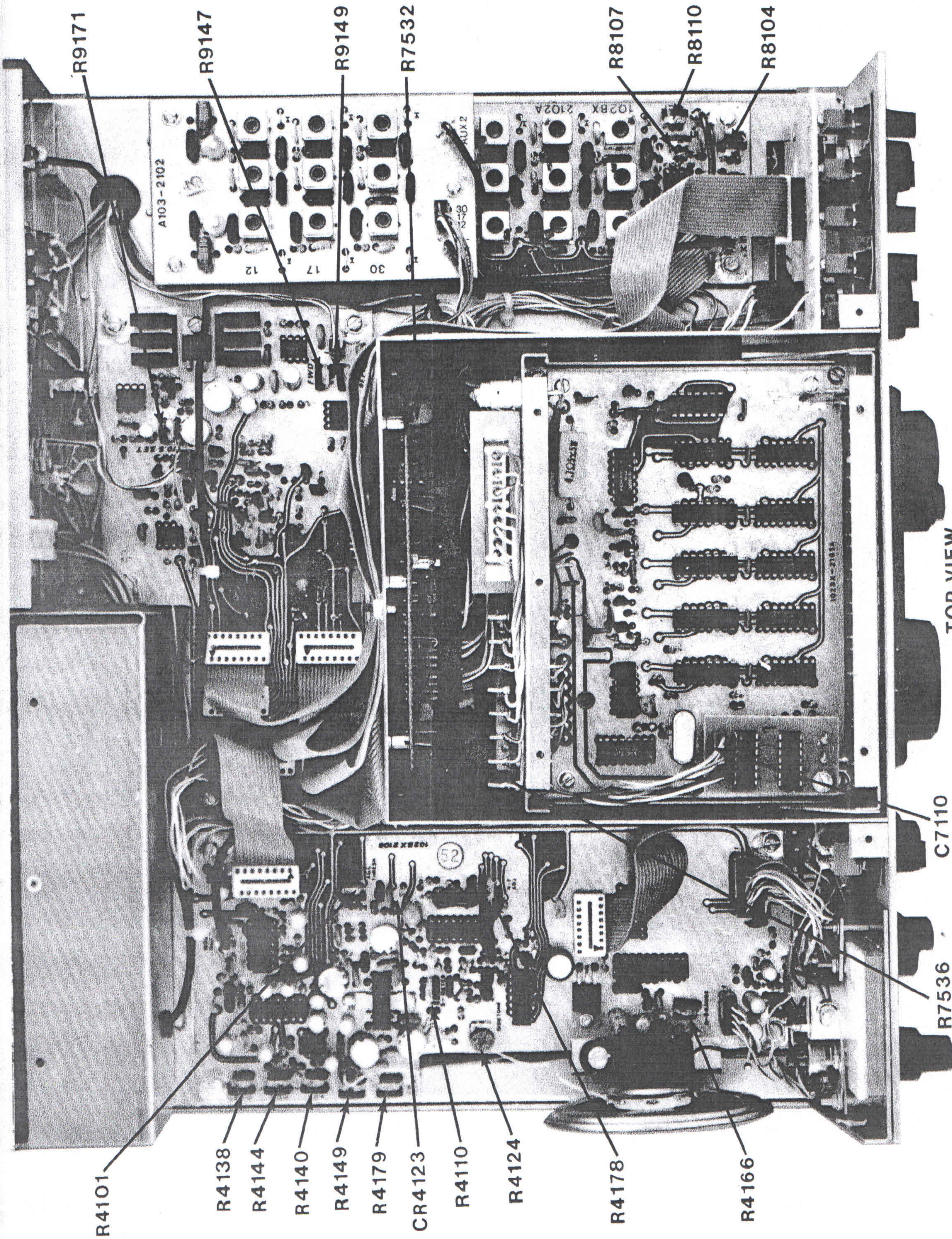
AUXILIARY PRESELECTOR BANDPASS FILTER ALIGNMENT TABLE

| <u>BAND</u> | <u>RANGE, MHz</u> | <u>CENTER FREQ</u> | <u>COILS</u>     |
|-------------|-------------------|--------------------|------------------|
| 30          | 10.0-10.5         | 10.250             | T207, T208, T209 |
| 17          | 18.0-18.5         | 18.250             | T204, T205, T206 |
| 12          | 24.5-25.0         | 24.750             | T201, T203, T203 |

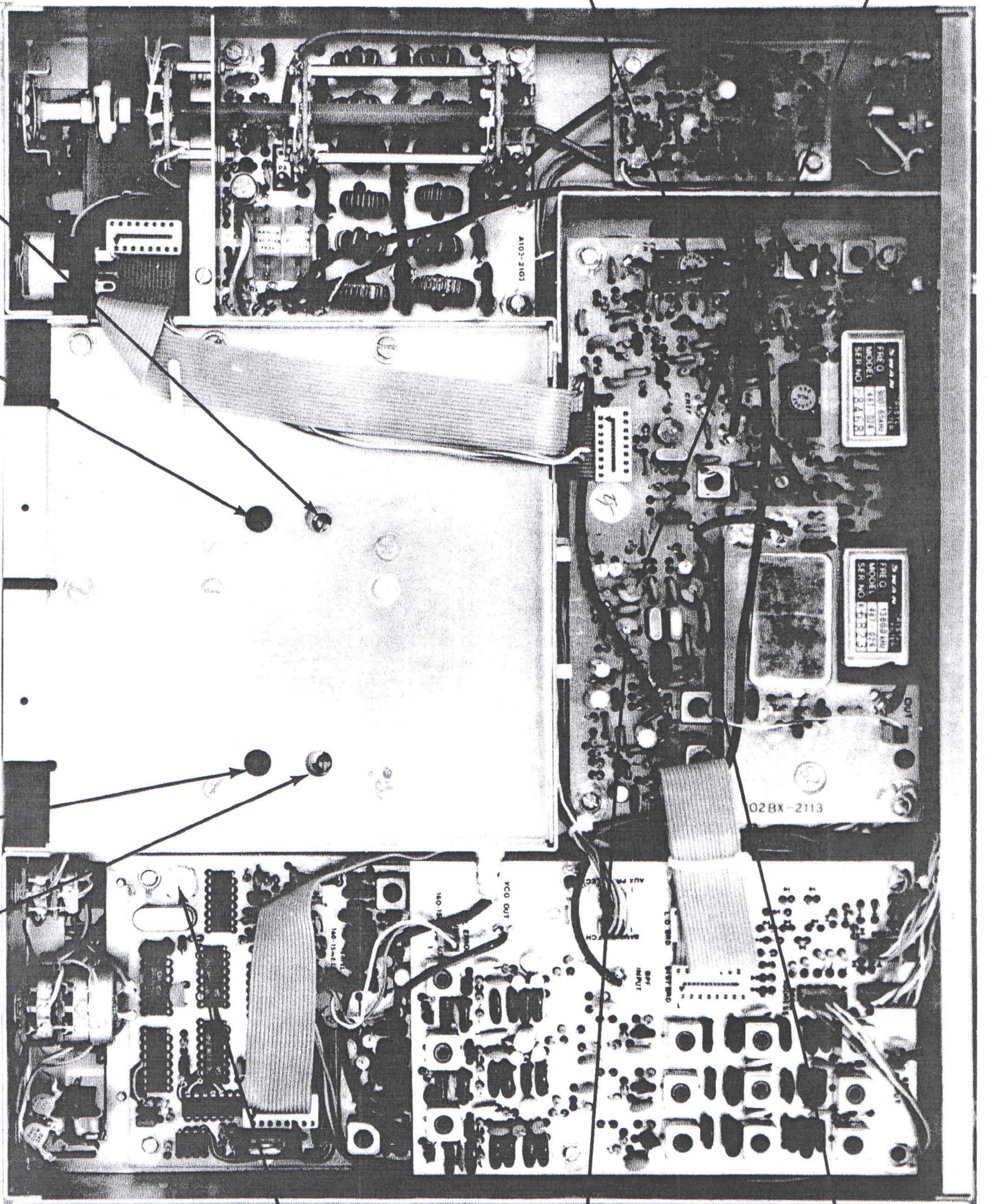
AUXILIARY L.O. BANDPASS FILTER ALIGNMENT TABLE

| <u>BAND</u> | <u>RANGE, MHz</u> | <u>CENTER FREQ</u> | <u>COILS</u>     |
|-------------|-------------------|--------------------|------------------|
| 30          | 19.0-19.5         | 19.250             | T210, T211, T212 |
| 17          | 27.0-27.5         | 27.250             | T207, T208, T209 |
| 12          | 33.5-34.0         | 33.750             | T204, T205, T206 |





TOP VIEW  
FIGURE 8-1



C2197

Z2101

C7606  
(BI)

C7608  
(BI)

FIGURE 8-2  
BOTTOM VIEW

C7608  
(A)

C7606(A)

C2194

C2199

C5246

## Parts

|  |     |
|--|-----|
| Low Pass Filter/Band Switch Board (3000 Series)..... | 9-2 |
| Auxiliary Local Oscillator Board (5200 Series).....  | 9-3 |
| Front Panel Right Board (7800 Series).....           | 9-2 |
| Auxiliary Preselector Board (8000 Series).....       | 9-4 |

Only parts unique to the ASTRO-103 are listed in this section. When referring to the parts lists for the ASTRO-102BX, the Lowpass Filter/Band Switch and the Front Panel, Right boards are replaced in their entirety. The Auxiliary Preselector, Auxiliary L.O. and Auxiliary Counter boards are new boards used only in the ASTRO-103.

LOWPASS FILTER/BANDSWITCH BOARD (3000 Series)

Changes for the ASTRO-103 Only

| Circuit Symbol | Cubic Part Number | Description                            |
|----------------|-------------------|--|
| K3102          | 111-036           | Relay, Reed SPST                       |
| L3107          | 027-081           | Coil, RF, 1.15 uH, 14T (30, 40 Meters) |
| L3108          | 027-081           | Coil, RF, 1.15 uH, 14T (30, 40 Meters) |
| L3111          | 027-098           | Coil, RF, 6.4 uH, 33T (160 Meters)     |
| L3112          | 027-098           | Coil, RF, 6.4 uH, 33T (160 Meters)     |
| S3101          | 171-205           | Switch Wafer                           |
| S3102          | 171-205           | Switch Wafer                           |
| S3103          | 171-205           | Switch Wafer                           |

FRONT PANEL, RIGHT BOARD (7800 Series)

Changes for the ASTRO-103 Only

| Circuit Symbol | Cubic Part Number | Description  |
|----------------|-------------------|--------------|
| S7802          | 171-188           | Switch, Mode |

AUXILIARY L.O. BOARD (5200 Series)

ASTRO-103 Only - Other parts similar to L.O. Board on ASTRO-102BX

| Circuit Symbol | Cubic Part Number | Description  |
|----------------|-------------------|--|
| T5201          | 012-231           | Transformer, RF 6T   |
| T5202          | 014-066           | Transformer, RF, 8T  |
| T5203          | 012-255           | Transformer, RF, 9T  |
| T5204          | 014-066           | Transformer, RF, 8T  |
| T5205          | 014-067           | Transformer, RF, 14T   |
| T5206          | 014-066           | Transformer, RF, 8T/12T  |
| T5207          | 014-066           | Transformer, RF, 8T  |
| T5208          | 014-067           | Transformer, RF, 14T   |
| T5209          | 014-066           | Transformer, RF, 8T/12T  |
| T5210          | 014-066           | Transformer, RF, 8T  |
| T5211          | 014-067           | Transformer, 14T   |
| T5212          | 014-066           | Transformer, RF, 8T/12T  |
| L5201          | 027-059           | RF Choke 1.5 uH  |
| L5202          | 027-059           | RF Choke 1.5 uH  |
| L5203          | 027-060           | RF Choke 1.8 uH  |
| L5204          | 027-060           | RF Choke 1.8 uH  |
| L5205          | 027-062           | RF Choke 2.7 uH  |
| L5206          | 027-062           | RF Choke 2.7 uH  |
| U5105          | 476-012           | PROM with code for ASTRO-103<br>Used on L.O. Board, replaces 476-008 |

AUXILIARY PRESELECTOR BOARD (8200 Series)

ASTRO-103 Only - Other parts similar to Preselector Board on ASTRO-102BX

| Circuit Symbol | Cubic Part Number | Description                 |
|----------------|-------------------|-----------------------------|
| L8201          | 012-269           | Coil, RF 7 uH, 40T          |
| L8202          | 012-269           | Coil, RF 17 uH, 40T         |
| C8218          | 089-028           | Capacitor, Trimmer 4-30 pf  |
| C8219          | 089-028           | Capacitor, Trimmer, 4-30 pf |
| T8201          | 014-066           | Transformer, RF, 8T/2T      |
| T8202          | 014-067           | Transformer, RF, 14T/3T     |
| T8203          | 014-066           | Transformer, RF 8T/2T       |
| T8204          | 014-067           | Transformer, RF 14T/3T      |
| T8205          | 014-068           | Transformer, RF 20T/3T      |
| T8206          | 014-068           | Transformer, RF 20T/3T      |
| T8208          | 014-069           | Transformer, RF, 32T/9T     |
| T8209          | 014-068           | Transformer, RF 20T/3T      |