

**INTERMEDIATE LEVEL MAINTENANCE MANUAL**  
**FOR THE**  
**HF-1000A DIGITAL HF RECEIVER**

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**WATKINS-JOHNSON COMPANY**  
**700 QUINCE ORCHARD ROAD**  
**GAITHERSBURG, MARYLAND 20878-1794**

November 1996

**PROPRIETARY STATEMENT**

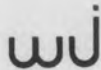
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## DECLARATION OF CONFORMITY

According to ISO/IEC Guide 22 and EN 45014

MANUFACTURER'S NAME:



**WATKINS-JOHNSON COMPANY**  
Electronic Equipment Division

MANUFACTURER'S ADDRESS:

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GAITHERSBURG, MARYLAND 20878-1794  
U.S.A.

DECLARES THAT THE PRODUCT

PRODUCT NAME: Digital HF Receiver

MODEL NUMBER: HF-1000

CONFORMS TO THE FOLLOWING SPECIFICATIONS AND/OR DIRECTIVES:

SAFETY: IEC 1010-1: 1990 and EN61010-1: 1993 w/Amendment A2:  
7/95

EMC: EN50081-1 (Radiated and Conducted Emissions to EN55022,  
Class B)  
EN50082-1 (Including IEC 801-2: 1984, IEC 801-3: 1984 and  
IEC 801-4: 1988)  
EN55020 (Immunity for Receivers)

SUPPLEMENTARY INFORMATION:

Directives Compliance: Low Voltage (Safety) 73/23/EEC  
EMC 89/336/EEC

AUTHORIZED SIGNATURE

A handwritten signature in black ink, appearing to read 'Barry N. Wright', written over a horizontal line.

BARRY N. WRIGHT  
MANAGER, PRODUCT ASSURANCE  
AND REGULATORY COMPLIANCE

LOCATION AND DATE OF DECLARATION:

Gaithersburg, Maryland, USA - March 19, 1996

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**EQUIPMENT OR PARTS DESCRIBED AS BEING MANUFACTURED BY OTHERS ARE SOLD BY SELLER AS IS** and Buyer must look to the respective manufacturer for any and all claims with regard to said equipment or parts.

## TECHNICAL NOTE

### HANDLING OF LITHIUM BATTERIES

#### WARNING

This unit contains a lithium battery as back up power for memory retention. Extreme care should be used in storage, handling, and disposal of lithium batteries. Improper handling may present explosion hazard.

- Always wear eye protection when handling batteries.
- Do not puncture, compact, incinerate, short circuit, or expose to temperatures above 160°F (71°C).
- Do not expose batteries to charging currents.
- Do not store loose batteries in bins. Always store in original containers.
- Dispose of batteries properly. Discharged cells should be handled with care, as they retain significant energy. They should be electrically isolated and packaged for disposal. Dispose in accordance with local regulations for hazardous material disposal. **DO NOT INCINERATE OR COMPACT.**

#### **HF-1000 DIGITAL HF RECEIVER BATTERY REPLACEMENT FOR UNITS CONTAINING THE TYPE 797012 DIGITAL ASSEMBLY (A2)**

The lithium battery contained in the HF-1000 Receiver is mounted in a battery holder on the Type 797012 Digital Assembly (A2). If replacement is required, carefully insert a blunt, nonmetallic, tool between the bottom face of the battery and the holder at one of the five slots provided. Pry the battery up at a slight angle and remove with fingers. Take care to avoid shorting the positive (+) and negative (-) contacts during the removal process. Install the replacement battery with the positive face up. Insert battery under the battery clip at a slight angle and slide in place.

#### **HF-1000 DIGITAL HF RECEIVER BATTERY REPLACEMENT FOR UNITS CONTAINING THE TYPE 797214 DIGITAL ASSEMBLY (A2)**

Refer to the instructions contained in **paragraph 7.8.15.**

**WARNING**

This equipment utilizes voltages which are potentially dangerous and may be fatal if contacted. Exercise extreme caution when working with the equipment with any protective cover removed.

**WARNING**

Due to the risk of a potentially fatal electrical shock hazard, never install or operate the receiver in areas where standing water is present or in an environment with humidity greater than 95%, with visible condensation.

**WARNING**

This equipment utilizes voltages which are potentially dangerous and may be fatal if contacted. Whenever a problem is suspected, repair and maintenance of the equipment should be performed by qualified maintenance personnel only. This equipment contains no user serviceable parts.

**Radio and Television Interference Statement**

The equipment described in this manual, the HF-1000, generates and uses radio frequency energy. If it is not installed and used properly, that is, in strict accordance with the manufacturer's instruction, it may cause interference to radio and television reception.

This equipment has been tested and complies with the limits for a Class B digital device in accordance with the specifications in Part 15 of the FCC Rules. These rules are designed to provide reasonable protection against such interference in a residential installation. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause interference to radio or television reception (household receiver), which can be determined by turning the equipment on and off, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient the receiving antenna of the household receiver.
- Relocate the HF-1000 with respect to the household receiver.
- Move the HF-1000 away from the household receiver.
- Plug the computer into a different outlet so that HF-1000 and the household receiver are on different branch circuits.
- If operating the HF-1000 in remote mode, use a shielded RS-232C or CSMA interface cable.

If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions. The user may find the following booklet, prepared by the Federal Communications Commission, helpful: *How to Identify and Resolve Radio and TV Interference Problems*. This booklet is available from the U.S. Government Printing Office, Washington, DC 20402.

**WARNING**

This equipment has been certified to comply with the limits for a Class B digital device under Part 15 of FCC Rules. Only peripherals (computer input/output devices, terminals, printers, etc.) certified to comply with the Class B limits may be attached to the HF-1000. Operation with non-certified peripherals is likely to result in interference to radio and TV reception. Any changes or modifications to this equipment not expressly approved by the manufacturer could void the user's authority to operate this equipment.

**REMARKS**

To meet FCC requirements, shielded interface cables are required to connect the device to a personal computer, peripheral, or other Class B certified device.



**HF-1000 DIGITAL HF RECEIVER****REVISION RECORD**

Revision	Description	Date
A	Initial issue. Preliminary.	8/93
B	Added information concerning the use of a shielded RS-232C interface cable to minimize interference to radio and television reception. Added Variable Bandwidths and the Tunable Notch Filter enhancements. Updated existing manual from a Class C to a Class B manual.	11/93
C	Revised specifications related to IF bandwidth shape factors.	12/93
D	Revised accessory parts information.	1/94
E	Added the Reference Frequency Timebase Accuracy alignment procedure	2/94
F	Provides information on enhancement to the AGC software and on the Synchronous AM Detection Mode. Documents updated Digital Control Assembly (A2).	3/95
G	Added information requiring use of shielded twisted pair cable with the CSMA interface to ensure electromagnetic compatibility. Added Declaration of Conformity to IEC EMC and Safety standards.	3/96
H	Corrected errata. Bit 6 of the Event Summary Status Register is not used. It cannot be used to flag front panel parameter changes. Improved AGC attack time specification from 15 ms to 5 ms.	4/96
I	Updated <b>Table 1-1</b> , Receiver Specifications Table. Updated <b>Figure 2-4</b> , Receiver Rear Panel to include warning and ID Labels	11/96

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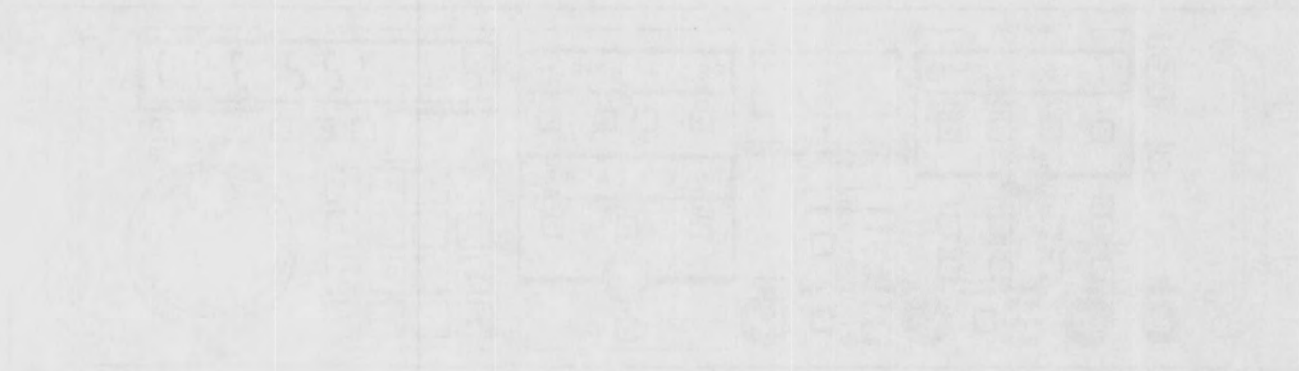
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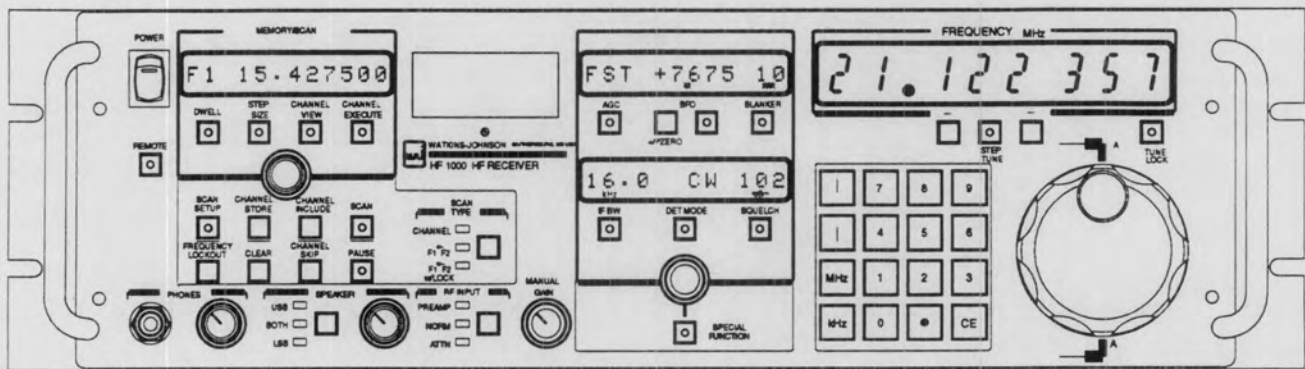
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**SECTION I**  
**GENERAL DESCRIPTION**



GENERAL DESCRIPTION

HF-1000 DIGITAL HF RECEIVER



95-527

Figure 1-1. HF-1000 HF Receiver

## SECTION I

### GENERAL DESCRIPTION

#### 1.1 ELECTRICAL CHARACTERISTICS

The HF-1000 Digital HF Receiver is a microprocessor-controlled, synthesized receiver capable of continuous 1 Hz tuning resolution over the frequency range of 5 kHz to 30.0 MHz. Available detection modes are AM, FM, CW, ISB, USB, LSB, and Synchronous AM (SAM). Selectable IF bandwidths, including 66 digital IF bandwidth filters and a tunable (non-linear phase) IF notch filter, are standard. Manual or automatic gain control (AGC) modes are selectable. In CW detection mode, beat frequency oscillator (BFO) and passband tuning capabilities are available. The BFO is adjustable over a  $\pm 8000$  Hz range. Passband tuning, which is an operator aid that facilitates simultaneous adjustments of tuned frequency and BFO, is adjustable over a  $\pm 2000$  Hz range.

The receiver's squelch threshold can be set to any value from 0 to -135 dBm or can be turned off. For use with HF transmitters, audio signals can be muted via the presence of an external control signal input at the receiver's rear panel.

In addition to fixed frequency tuning, the HF-1000 provides a flexible scanning capability. Three scan types are available: channel scan, frequency-to-frequency scan (F1 to F2), and frequency-to-frequency scan with lockouts. In channel scan mode, the receiver steps through a sequence of up to 100 user-programmable memory channels. Receiver parameters stored in each channel include frequency, IF bandwidth, detection mode, BFO, gain control mode, manual gain value, and squelch threshold. Prior to initiating the channel scan, the operator may select a specific range of channels to scan through. Individual channels within the range can be identified for the receiver to skip over during the scan. In both frequency-to-frequency scan modes, the receiver monitors frequencies between programmed start and stop frequencies according to a selected step size between 1 Hz and 25 kHz. For all scan modes, the receiver automatically stops when a signal is acquired that breaks the squelch threshold level. The duration of time the receiver holds on a signal before resuming scan (dwell time) is operator-selectable between 0.5 and 20 seconds. An infinite dwell time can also be selected. A built-in-test (BITE) function is available which can be used to verify equipment performance.

The HF-1000 can be operated locally or remotely. Local operations can be performed using the controls, indicators and displays located on the receiver's front panel (see **Figure 1-1**). The indication of the receiver's tuned frequency is provided on a dedicated 8-digit numeric display. Three separate 12-character alphanumeric displays are provided: one for memory/scan operations and two for general receiver parameter entries. A separate signal strength meter is also provided.

Remotely, the HF-1000 can be controlled either via an RS-232C interface or via a Carrier Sense/Multiple Access (CSMA) interface bus. Both remote interfaces allow for parameters such as tuned frequency, detection mode, IF bandwidth, gain mode, manual gain, and RF input path to be controlled remotely. Additionally BITE can be initiated from the RS-232C interface as well as status reporting.

GENERAL DESCRIPTION

HF-1000 DIGITAL HF RECEIVER

The HF-1000's internal power supply accepts 100-254 VAC, 47-440 Hz line power as its power source. The unit's internal power supply automatically adjusts to the input power, providing it is within the acceptable limits. The total power consumption of the unit is less than 35 watts.

Refer to **Table 1-1** for a complete listing of HF-1000 Digital HF Receiver specifications.

**Table 1-1. HF-1000 Digital HF Receiver Specifications**

Frequency Range .....	5 kHz to 30 MHz (Tunable to 0 Hz, degraded performance below 500 kHz)		
Tuning Resolution .....	1 Hz		
Internal Reference Stability .....	Better than 1.0 PPM (0 to 50°C)		
External Reference Frequency .....	Accepts 1, 2, 5 or 10 MHz ( $\pm 1$ PPM or better, 200 mV rms into high impedance load). Automatically switches to external reference upon application of signal		
Synthesizer Lock Time .....	Less than 10 msec typical		
Antenna Input			
Impedance .....	50 ohms, nominal		
VSWR .....	2:1 maximum at receiver's tuned frequency		
Maximum Input Signal .....	+30 dBm		
Connector .....	BNC female		
Third Order Intercept Point .....	+30 dBm typical, +25 dBm minimum (for signals separated by 20 kHz minimum)		
Second Order Intercept Point .....	+60 dBm typical		
Noise Figure .....	14 dB maximum (11 dB maximum with preamplifier engaged)		
Detection modes .....	AM, FM, CW, USB, LSB, ISB and SAM (Consult factory for additional demodulation modes)		
Sensitivity (500 kHz - 30 MHz)			
Modulation	IF BW	S+N/N Min	Without Preamp dBm/ $\mu$ V
AM (50% mod. at 400 Hz)	6.0 kHz	10 dB	-103/(1.58)
USB/LSB/ISB	3.2 kHz	10 dB	-112/(0.56)
CW	0.3 kHz	16 dB	-116/(0.35)
CW Sensitivity, 5 kHz - 500 kHz, without Preamp (0.3 kHz IF Bandwidth)			
50 kHz - 500 kHz .....	-113/(0.5) dBm/( $\mu$ V) typical for 16 dB S+N/N		
20 kHz - 50 kHz .....	-105/(1.27) dBm/( $\mu$ V) typical for 16 dB S+N/N		
5 kHz - 20 kHz .....	-78/(28) dBm/( $\mu$ V) typical for 16 dB S+N/N		

**Table 1-1. HF-1000 Digital HF Receiver Specifications (Continued)**

IF Bandwidths:.....	3 dB <u>Bandwidths</u>	Typical Shape Factor <u>(3/60 dB)</u>	3 dB <u>Bandwidths</u>	Typical Shape Factor <u>(3/60 dB)</u>
	.056 kHz	1.45:1	1.000 kHz	1.40:1
	.063 kHz	1.40:1	1.100 kHz	1.40:1
	.069 kHz	1.40:1	1.200 kHz	1.35:1
	.075 kHz	1.35:1	1.300 kHz	1.35:1
	.081 kHz	1.35:1	1.400 kHz	1.35:1
	.088 kHz	1.35:1	1.500 kHz	1.35:1
	.094 kHz	1.35:1	1.600 kHz	1.30:1
	.100 kHz	1.30:1	1.800 kHz	1.45:1
	.113 kHz	1.45:1	2.000 kHz	1.40:1
	.125 kHz	1.40:1	2.200 kHz	1.40:1
	.138 kHz	1.40:1	2.400 kHz	1.35:1
	.150 kHz	1.35:1	2.600 kHz	1.35:1
	.163 kHz	1.35:1	2.800 kHz	1.35:1
	.175 kHz	1.35:1	3.000 kHz	1.35:1
	.188 kHz	1.35:1	3.200 kHz	1.30:1
	.200 kHz	1.30:1	3.600 kHz	1.45:1
	.225 kHz	1.45:1	4.000 kHz	1.40:1
	.250 kHz	1.40:1	4.400 kHz	1.40:1
	.275 kHz	1.40:1	4.800 kHz	1.35:1
	.300 kHz	1.35:1	5.200 kHz	1.35:1
	.325 kHz	1.35:1	5.600 kHz	1.35:1
	.350 kHz	1.35:1	6.000 kHz	1.35:1
	.375 kHz	1.35:1	6.400 kHz	1.30:1
	.400 kHz	1.30:1	7.200 kHz	1.45:1
	.450 kHz	1.45:1	8.000 kHz	1.40:1
	.500 kHz	1.40:1		
	.550 kHz	1.40:1		
	.600 kHz	1.35:1		
	.650 kHz	1.35:1		
	.700 kHz	1.35:1		
	.750 kHz	1.35:1		
	.800 kHz	1.30:1		
	.900 kHz	1.45:1		

(Consult factory for alternate or additional IF bandwidths)



**Table 1-1. HF-1000 Digital HF Receiver Specifications (Continued)**

<b>IF Output</b>	
Center Frequency.....	455 kHz, nominal
Output Level.....	-20 dBm, nominal
Output Impedance.....	50 ohms, nominal
Connector Type .....	BNC female
<b>Signal Monitor Output</b>	
Center Frequency.....	455 kHz, nominal; inverted
Bandwidth .....	8 kHz (-6 dB) nominal
Output Level.....	30 dB above RF Input, nominal
Output Impedance .....	50 ohms, nominal
Connector Type .....	BNC female
<b>Gain Control Modes .....</b>	
	Manual, AGC Fast, Medium, and Slow
AGC Range .....	100 dB minimum
AGC Threshold .....	Variable. When enabled locally through SPECIAL FUNCTION key and AUXILIARY PARAMETER EDIT knob, operator controls with MANUAL GAIN. Remotely enabled by operator with AGT command and controlled with RFG command.
AGC Attack Time.....	5 msec typical
AGC Decay Time .....	Fast: 10-100 msec variable in 10 ms steps Medium: 100-1000 ms variable in 100 ms steps Slow: 1-5 sec variable in 0.5 sec steps
Manual Gain Control Range .....	>100 dB
<b>Selectable Front End Gain/Attenuation</b>	
Preamplifier Gain .....	10 dB ( $\pm 2$ dB)
Attenuation .....	15 dB ( $\pm 2$ dB)
<b>Beat Frequency Oscillator (BFO)</b>	
Tuning Range .....	$\pm 8000$ Hz
Tuning Resolution .....	10 Hz
Image Rejection.....	90 dB minimum
IF Rejection .....	85 dB minimum, greater than 90 dB typical
Internal Spurious Responses.....	<-114 dBm, referred to the RF input.
Local Oscillator Phase Noise.....	-110 dBc @ 1 kHz offset, typical
Reciprocal Mixing .....	With a desired signal of 25 $\mu$ V in the 3.2 kHz IF bandwidth, the desired signal-to-noise ratio (SNR) is greater than 20 dB when an undesired signal, 70 dB higher in amplitude and 35 kHz removed in frequency, is present.
Cross Modulation .....	With a desired signal of 10 $\mu$ V an undesired signal 86 dB higher, 30% AM modulated produces less than 10% cross modulation for frequency separation of greater than 50 kHz in the 1 kHz IF bandwidth.
Blocking .....	An unwanted signal 1 mV separated 20 kHz from a desired signal of 1 $\mu$ V will not cause the IF output to fall by more than 3 dB.

**Table 1-1. HF-1000 Digital HF Receiver Specifications (Continued)**

<b>Line Audio Outputs</b>	
Number of Outputs .....	Two center-tapped, balanced outputs. For ISB mode, USB and LSB on separate outputs. For all other modes, audio signal is common to both outputs.
Output Level .....	0 dBm nominal into 600 ohm load
Connector Type .....	Screw Terminals
<b>Speaker Output</b>	
Number of Outputs .....	One output. For ISB mode, USB and LSB can be selected individually or combined. (Internal Speaker optional)
Bandwidth.....	100 Hz to 13 kHz
Output Level .....	Adjustable up to 1 watt into 8 ohm load
Total Harmonic Distortion.....	Less than 3% at 1 watt
Connector Type .....	Screw terminals
<b>Headphone Output</b>	
Number of Outputs .....	Two unbalanced outputs. For ISB mode, one output contains USB (left channel), the other contains LSB (right channel). In all other modes, the audio signal is common to both outputs
Output Level .....	Adjustable up to 10 mW into 600 ohm load
Connector Type .....	Standard 1/4" stereo jack
<b>Remote Control</b> .....	
	RS-232 or CSMA; selectable by internal switch or front panel entry
RS-232.....	Full duplex, 3-wire serial interface; rear panel 25-pin female D-shell connector
CSMA.....	Carrier Sense/Multiple Access with Collision Detection; half duplex; rear panel miniature phone jack
Baud Rates (Both Interfaces) .....	75, 150, 300, 600, 1200, 2400, 4800 and 9600; selectable by internal switches or front panel entry.
Operating Temperature.....	0°C to +50°C
Storage Temperature.....	-40°C to +70°C
Humidity.....	95%, non-condensing
Shock.....	Bench Handling (Field Service) 8 drops total onto a horizontal hard wooden surface - operating.
MTBF.....	In excess of 10,000 hrs.
Power Requirements.....	100 to 254 VAC, 47 to 440 Hz
Power Consumption .....	35 watts typical with options
Dimensions .....	5.25 inches high by 19.0 inches wide by 20.0 inches deep
Weight .....	15 pounds

## 1.2 MECHANICAL CHARACTERISTICS

The HF-1000 is designed in a full 19-inch rack configuration, occupying 5.25 of vertical rack space and extending 16 inches into the equipment rack. Front panel mounting brackets are provided for installation with the equipment rack. A #10 threaded grounding stud is located on the rear panel for grounding the receiver in the rack. See **paragraph 2.2.1** for rack mounting instructions.

All operation controls and indicators are located on the front panel. All input and output connectors (except for the PHONES jack) are located on the rear panel. Connector types used are BNC, multipin, mini-phones, 1/4-inch stereo headphones jack, and a 13 terminal audio terminal block.

The top and bottom covers and main chassis are constructed of aluminum. The top cover is removable and held in place with 10 screws. Removal of the top cover provides access to all internal circuitry including the following four major assemblies: the Type 797214-1 Digital Assembly, the Type 797006-1 RF Assembly, the Type 841704 Power Supply Assembly, and the Type 797015-1 Front Panel Assembly.

## 1.3 EQUIPMENT SUPPLIED

Equipment supplied with the HF-1000 consists of an Installation and Operation Manual, a six-foot AC power cord, three 1-amp fuses, one D-type mating connector, a BNC adapter, and four plastic feet that can be easily installed on the bottom of the unit for table top operation. See **paragraph 8.5.4** for a detailed accessory parts list.

## 1.4 EQUIPMENT REQUIRED BUT NOT SUPPLIED

To obtain full utilization of the receiver, equipment from the following list should be selected:

- HF Antenna, 50 ohm
- Headphones, 600 ohms
- Line audio monitoring equipment
- Signal Monitoring equipment
- Remote Controller, CSMA or RS-232C compatible
- Shielded RS-232C or CSMA interface cable

1.5 **RECEIVER OPTIONS**

1.5.1 **WJ-8711/PRE SUBOCTAVE PRESELECTOR OPTION**

This option provides band filtering of the incoming RF spectrum between 0 and 30 MHz for improved second and third order intercept point performance. The WJ-8711/PRE option uses eleven separate filter bands, each covering a segment of the overall range. The appropriate filter is automatically selected as the receiver is tuned. Refer to **Appendix B** for further information on the WJ-8711/PRE option.


1.5.2 **WJ-8711/DSO1 DIGITAL SIGNAL OUTPUT OPTION**

This option provides a digital time samples of 25-kHz 3rd IF, switched IF and/or audio data via an added rear panel connector. Refer to **Appendix D** for further information on the WJ-8711/DSO1 option.

**SECTION II**  
**INSTALLATION**

INSTALLATION

NOTES

1. POWER REQUIREMENTS:  
 INPUT POWER 40 WATTS MAXIMUM  
 INPUT VOLTAGE 90 TO 264 VAC
- ⚠ IDENTIFIES MAXIMUM PROTRUSION OF FRONT PANEL ITEMS.
- ⚠ THE EQUIPMENT WILL OPERATE IN A FREE AIR AMBIENT AT SEA LEVEL FROM -10°C TO +55°C WITH COMPLETE PERFORMANCE SPECIFICATIONS BEING MET FROM 0°C TO 50°C. WHERE THE ENVIRONMENT VARIES FROM FREE AIR AMBIENT AT SEA LEVEL SUFFICIENT AIR SPACE AND/OR VOLUME OF COOLING AIR MUST BE PROVIDED AROUND THE UNIT TO DISSIPATE THE HEAT DEVELOPED.
- ⚠ WEIGHT: 10.3 LBS. NOMINAL
- ⚠ CENTER OF GRAVITY IS APPROXIMATELY AT POINT IDENTIFIED BY 
- ⚠ SLIDE (OPTIONAL) MANUFACTURED BY: JONATHAN MANUFACTURING CO.  
 FULLERTON, CA 92832  
 MFR CODE 05238 PART NO. 1100D-18-2
- ⚠ IT IS SUGGESTED THAT THE FRONT PANEL BE SECURED TO THE RACK AS SHOWN IN DETAIL "A".
- ⚠ SLIDE MOUNTING HOLES TYPICAL BOTH SIDES.

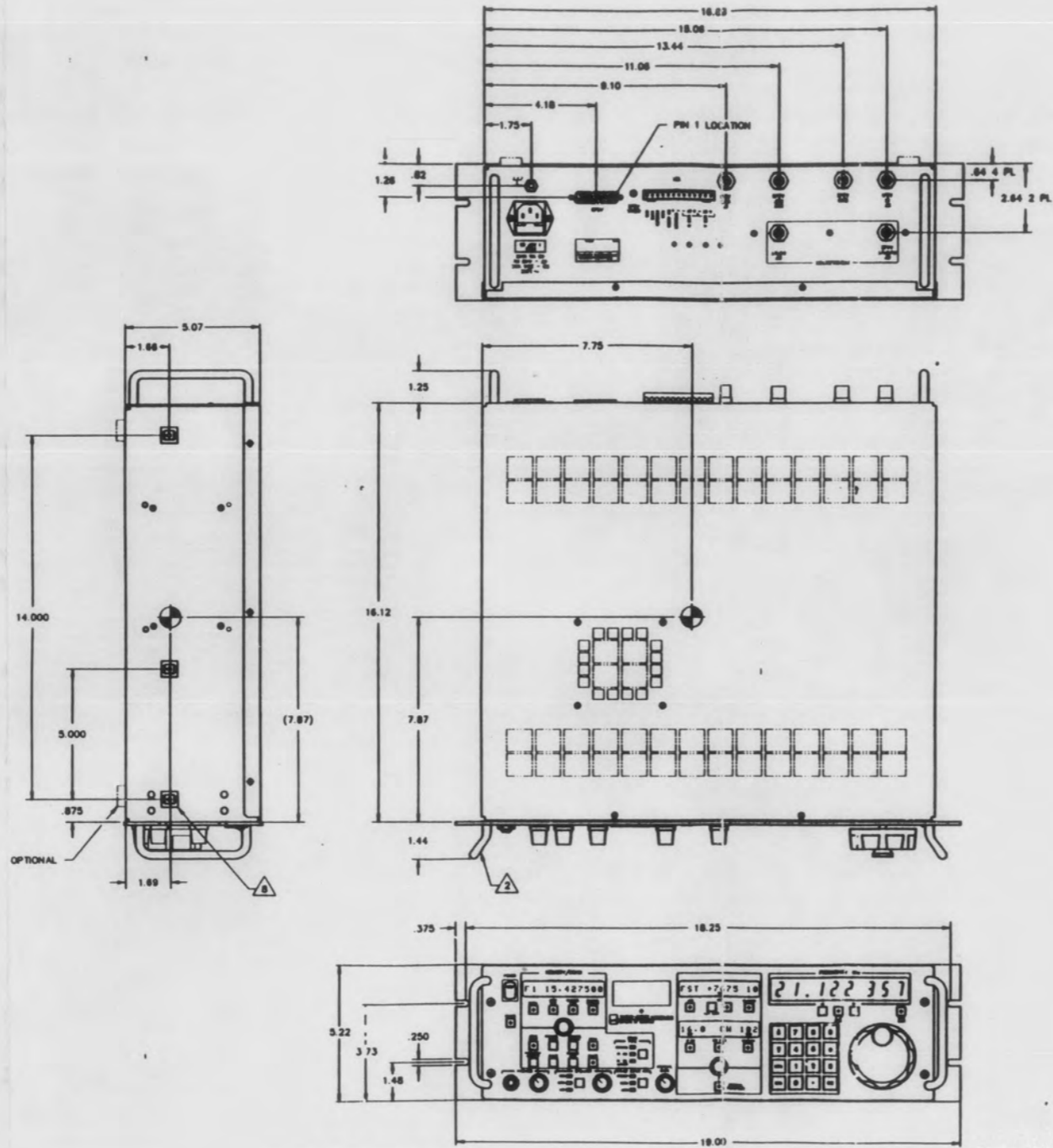
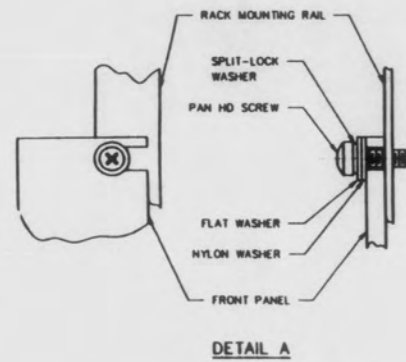


Figure 2-1. HF-1000 Critical Dimensions Diagram

## SECTION II

### INSTALLATION

#### 2.1 UNPACKING AND INSPECTION

Watkins-Johnson Company ships the HF-1000 and its accessories in a cardboard shipping container, designed specifically for its dimensions and weight. After unpacking the equipment, retain the shipping container and packing material until the equipment has been thoroughly inspected and it is ensured that reshipment is not necessary. Perform the following initial inspection:

1. Carefully inspect the outside of the shipping container for discoloring, stains, charring, or other signs of exposure to excessive heat, moisture, or liquid chemicals. Check for any signs of excessive shock or careless handling.
2. Remove all equipment and accessories from the shipping container. If any items are missing, contact the factory or your Watkins-Johnson representative.
3. Remove and retain the white 5x6 inch PRODUCT DISCREPANCY REPORT card. This card should be used if reshipment of the equipment is required. It also contains important warranty adjustment information.
4. Carefully inspect the equipment for dents, scratches, damaged or loose pushbuttons or knobs, or any other signs of physical abuse or careless handling during shipment.

If damage is found, forward an immediate request to the delivering carrier to perform an inspection and prepare a concealed-damage report. Do not destroy any packing material until it has been examined by an agent of the carrier. Concurrently, report the nature and extent of damage to the Watkins-Johnson Company, giving equipment serial numbers, so that necessary action can be taken. Under U.S. shipping regulations, claims for damage must be collected by the consignee; do not return the equipment to the Watkins-Johnson Company until a claim for damages has been established.

#### 2.2 INSTALLATION

##### 2.2.1 RACK MOUNTING

The HF-1000 Digital HF Receiver is designed so it can be mounted in a standard 19-inch equipment rack. The unit is 5.25 inches high and extends approximately 16 inches into the equipment rack (Figure 2-1). The use of Jonathan Type 110QD-16-2 chassis slides are recommended for racking mounting the HF-1000.

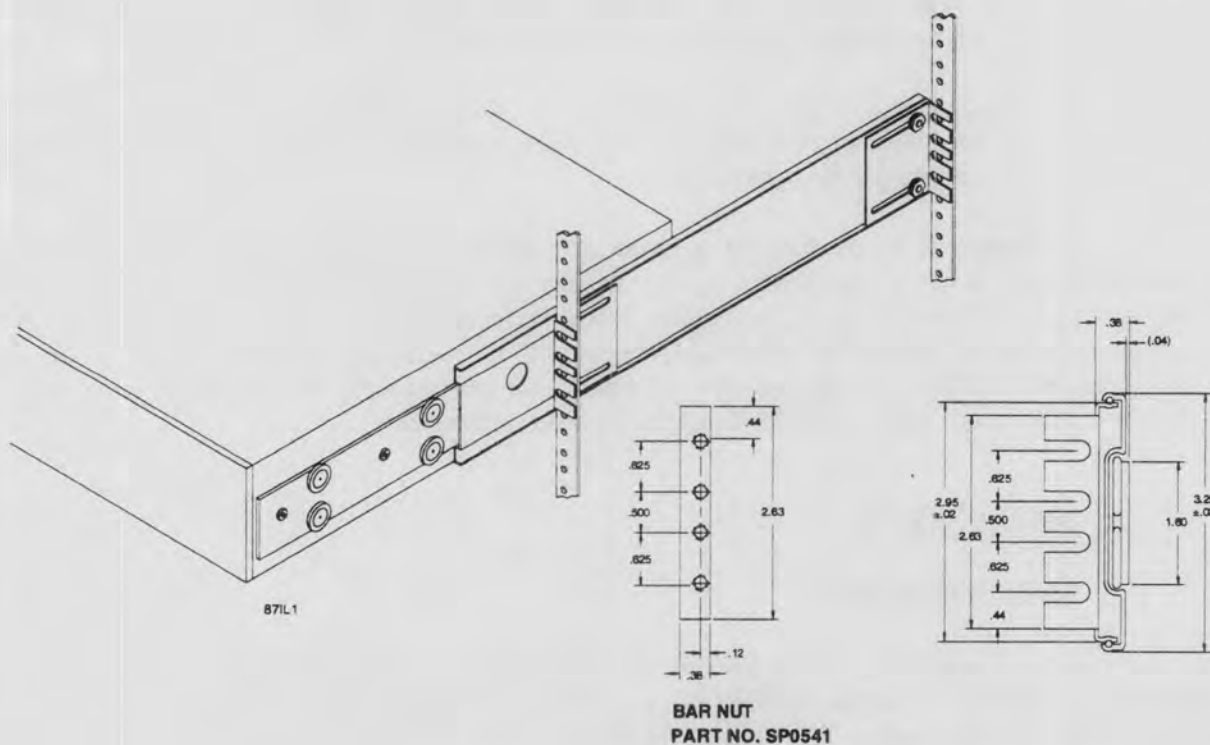
The Type 110QD-16-2 chassis slides accommodate the HF-1000's 17-inch wide chassis into a standard 19-inch wide equipment rack. Supporting loads up to 120 pounds, these slides mount easily into bracketed equipment racks using machined bar nuts. Figure 2-2 illustrates installation of the chassis slides to an equipment rack, with special attention given to bracket hole spacing.



**CAUTION**

Do not use screws longer than 5/16 inch in slide mounting holes of the HF-1000. Damage may result to the unit.

Each of the Type 110QD-16-2 chassis slides are comprised of two functional pieces: a chassis section for mounting to the unit and a cabinet section for mounting to the equipment rack. Three 10-32 X 5/16 pan head screws are used to install each chassis section to a side panel of the unit. After both chassis sections have been securely tightened to the unit, cabinet sections are to be installed within the equipment rack. The HF-1000 occupies 5.25 inches of vertical rack space (eight bracket holes). Four of the holes are used to secure the cabinet section of the slide to the equipment rack. Two outer holes are used to secure the unit's front panel to the equipment rack. Slide locks permit quick disconnect of the chassis section of the slides from the cabinet sections for equipment removal. A #10 threaded grounding stud is located on the rear panel for grounding the receiver in the equipment rack. See **paragraph 2.2.4.10**.



**Figure 2-2. Installation of Jonathan Type 110QD-16-2 Slide Mounts**



2.2.2 MOUNTING FEET FOR TABLE TOP OPERATION

The HF-1000 can be operated on a bench, table top, or any other clean, dry, secure surface. Provided in the receiver's accessory kit are four plastic mounting feet. These feet should be installed for table top operation.

Four holes are provided on the bottom panel of the receiver for installation of the mounting feet (see **Figure 2-3**). These holes are located approximately 1 inch from the outside corners of the bottom panel. To mount the feet, first make sure their rivet posts are extended. Align each foot with a mounting hole and press in on their rivet posts until they "click" in place.

To remove the feet, first remove the top cover. Place the receiver on its side and locate the extended feet posts inside the receiver's chassis. Push on the rivet posts of the feet to release them from the chassis. Reinstall the top cover.

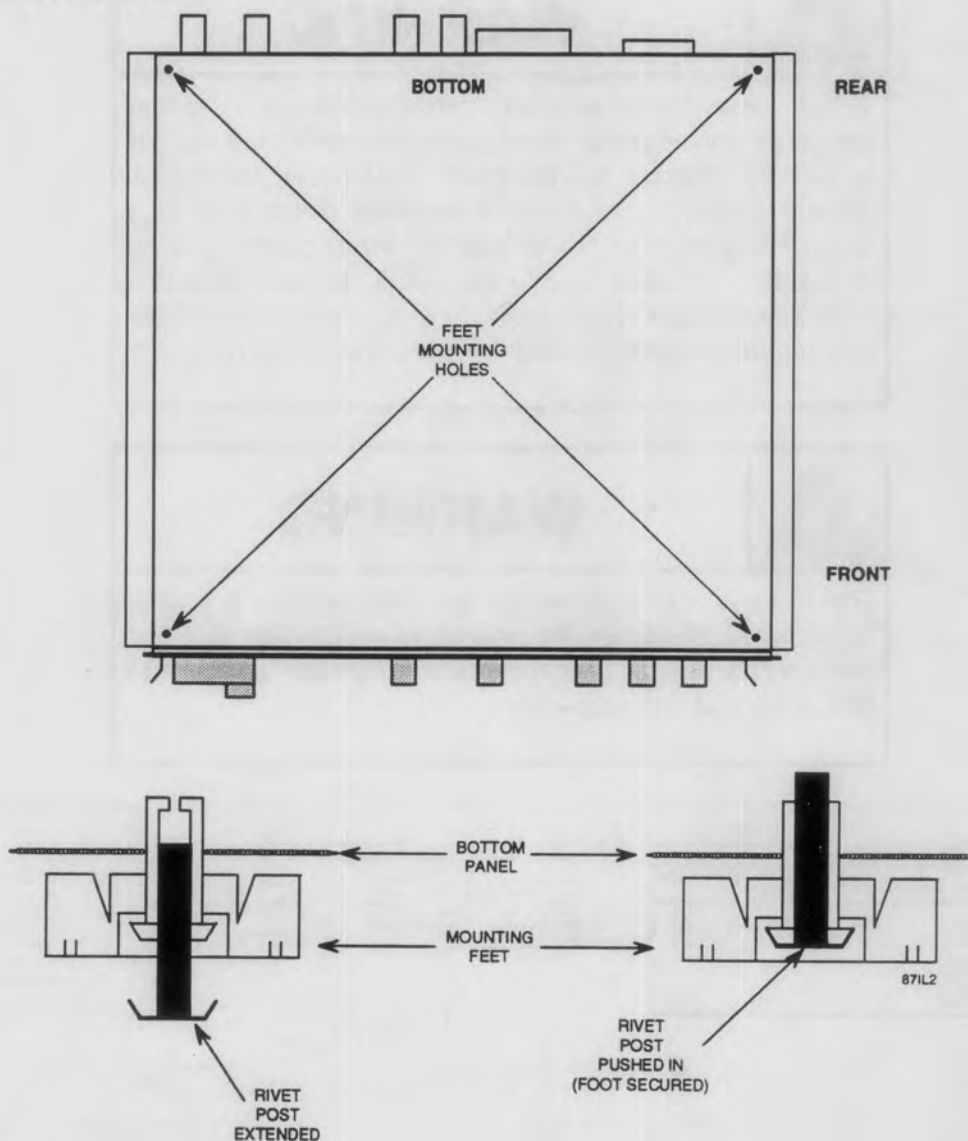


Figure 2-3. Installing the Mounting Feet for Table Top Operation

2.2.3 POWER REQUIREMENTS

The HF-1000 requires an input voltage of 100-254 VAC at 47 to 440 Hz for operation. The receiver's internal power supply circuitry automatically adjusts to the power input applied (providing it is within the specified range). Therefore, no manual switching of power source voltage selection is required. The six-foot line power cord supplied with the receiver connects to the three-prong POWER connector (FL1J1) located on the rear panel. The HF-1000 requires approximately 35 watts for operation.

A 1 amp, slo-blo fuse (FL1F1) is provided and located in a fuse case on the rear panel of the receiver (see **Figure 2-4**). This type fuse is to be used for operation anywhere in the VAC range.

## WARNING

Before connecting the receiver's power cord to an AC power source, ensure the power switch on the receiver's front panel is in the OFF position and the power LED is not illuminated. Always connect the supplied three-prong power cord to a grounded three-prong power outlet to ensure proper receiver grounding. Failure to comply with proper grounding requirements may cause radio and television interference and/or produce a possible electrical hazard to the operator.

## WARNING

Due to the risk of a potentially fatal electrical shock hazard, never install or operate the receiver in areas where standing water is present or in a environment with humidity greater than 95%, with visible condensation.

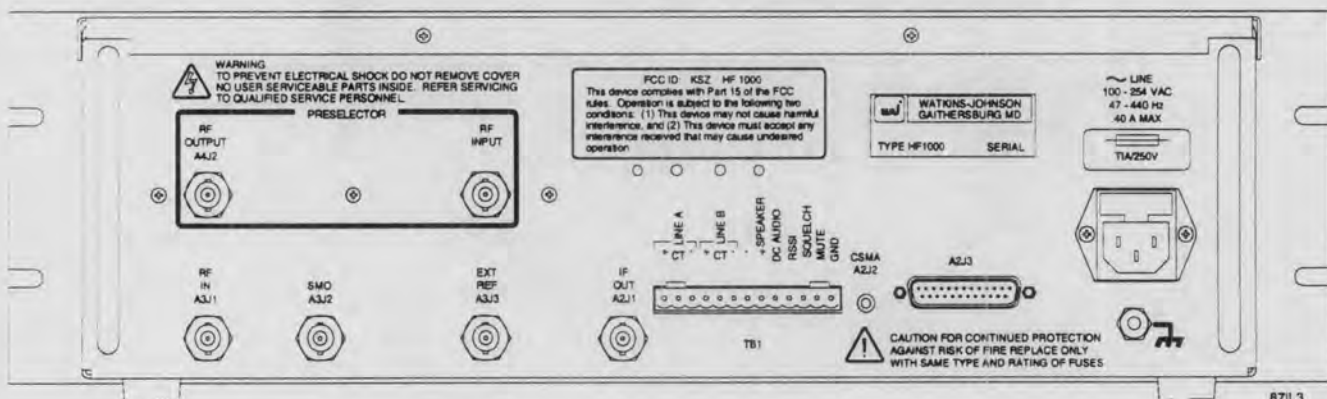


Figure 2-4. HF-1000 Rear Panel

To replace the fuse, first turn off the receiver and disconnect the power cord from the rear panel. Grasp the fuse case and pull straight out of its compartment in FL1. Remove the fuse from the fuse case and replace with a 250 V, 1 amp, slo-blo fuse. Reinstall the fuse case in its compartment and press firmly until it "clicks" in place. Reconnect the power cord.

#### 2.2.4 CONNECTOR SIGNALS

All external connectors of the HF-1000 are located on the rear panel, with the exception of the PHONES jack which is located on the front panel. **Table 2-1** lists these connectors and provides a brief description and the reference designation for each. **Figure 2-4** shows the location of the rear panel connectors. The following paragraphs provide details of the signals resident at the connectors.

2.2.4.1 **RF IN, Antenna Input (A3J1)** - This BNC female connector accepts the 5 kHz-30.0 MHz RF input from the antenna or the HF-1000/PRE Preselector option (if installed). Input impedance is nominally 50 ohms.

2.2.4.2 **SMO, Signal Monitor Output (A3J2)** - The signal monitor output is a BNC female connector, which provides a sample of the 2nd intermediate frequency, centered at 455 kHz with a minimum bandwidth of 30 kHz at -6 dB and an inverted spectrum. The nominal output impedance is 50 ohms with approximately 25 dB of gain from the antenna input. This output may be used by a signal monitor or other ancillary equipment.

2.2.4.3 **EXT REF, External Reference Input (A3J3)** - This female BNC connector allows an external 1 MHz, 2 MHz, 5 MHz, or 10 MHz reference input, having a minimum level of 200 mV rms into a high impedance load, to be used as the time base for the receiver. The HF-1000 automatically switches to external reference operation upon sensing the external reference input signal (providing it is within the specified limits).

2.2.4.4 **IF OUT, Post-Filtered IF Output (A2J1)** - This BNC female connector provides the post-filtered IF output. The output is centered at 455 kHz with a bandwidth equal to the operator-selected IF bandwidth. The minimum output level is -21 dBm (20 mV) into a 50 ohm load.

2.2.4.5 **CSMA, Carrier Sense/Multiple Access Port (A2J2)** - This mini-phone connector is used as the interface port for Carrier Sense/Multiple Access (CSMA) remote operations. The connector's center conductor carries the remote data while the sleeve is ground. To ensure electromagnetic compatibility (EMC) with other devices in accordance with IEC EMC standards, use a shielded twisted pair cable when interfacing with the HF-1000 through the CSMA port. See **Section V** of this manual for details on the CSMA remote interface and operations.

2.2.4.6 **A2J3, RS-232C Serial Interface Port** - This D-type, 25-pin connector is used as the interface port for RS-232C remote operations. The RS-232C interface operates as a full duplex interface at a selectable baud rate of 75 to 9600 bps. Pin 2 of this connector is the transmit data line (TXD), pin 3 is the receive data line (RXD) and pin 7 is ground. See **Section IV** of this manual for details on the RS-232C remote interface and operations.

**Table 2-1. List of Connectors**

Connector	Reference Designation	Function
RF IN	A3J1	BNC female. RF input from an antenna (or from A4J2 Preselector Output, when configured with HF-1000/PRE option).
SMO	A3J2	BNC female. Signal monitor output.
EXT REF	A3J3	BNC female. 1, 2, 5, or 10 MHz reference input.
IF OUT	A2J1	BNC female. Post-filtered IF output.
CSMA	A2J2	Mini-phone. Carrier Sense/Multiple Access (CSMA) remote interface port. (Not used in HF-1000-1).
A2J3	A2J3	D-Type, 25-pin. RS-232C remote serial interface port.
TB1	TB1	Thirteen-terminal audio terminal block. Provides connection for two variable line audio outputs, DC-coupled audio output, speaker output, remote signal strength indication output, squelch output, and mute input.
POWER	FL1J1	Three-prong male receptacle, mates with line power cord. 100-254 VAC 47-440 Hz power input.
PHONES	A1J1	1/4-inch stereo headphones jack. Headphones audio.
PRESELECTOR RF INPUT	A4J1	BNC female. RF input to HF-1000/PRE option (see <b>Appendix B</b> for detail on HF-1000/PRE option).
PRESELECTOR RF OUTPUT	A4J2	BNC female. Preselected RF output from HF-1000/PRE option (see <b>Appendix B</b> for detail on HF-1000/PRE option).

2.2.4.7 **TB1, Audio Terminal Block (TB1)** - This terminal block contains 13 terminals for connection of various inputs and outputs of the receiver such as line audio outputs, speaker outputs, DC-coupled audio output, remote signal strength indicator output, squelch output, and mute input. These input and outputs at the terminals of A2TB1 are further described in the following paragraphs.

**2.2.4.7.1 Line Audio Outputs (TB1 Terminals 1 thru 6)** - Terminals 1 thru 6 of TB1 provide two, center-tapped balanced line audio outputs. One of the line audio outputs (LINE A) is provided on the combination of terminals 1, 2, and 3. Terminal 1 is the positive output (LINE A (+)), terminal 3 is the negative output (LINE A (-)) and terminal 2 is the ungrounded center tap output (LINE A (CT)).

The other line audio output (LINE B) is provided on the combination of terminals 4, 5, and 6. Terminal 4 is the positive output (LINE B (+)), terminal 6 is the negative output (LINE B (-)), and terminal 5 is the ungrounded center tap output (LINE B (CT)).

When the independent sideband (ISB) detection mode is selected, the LINE A output provides upper sideband (USB) audio while the LINE B output provides lower sideband (LSB) audio. In all other detection modes, the LINE A and LINE B outputs provide identical signal content.

The output signal level for input signals above the AGC threshold is 0 dBm nominal ( $\pm 3$  dB). Output impedance for both line audio outputs is 600 ohms ( $\pm 30$  ohms). The bandwidth for both line audio outputs is 0.1 to 13.0 kHz,  $\pm 3$  dB. Continuous short circuit protection is provided for both outputs.

**2.2.4.7.2 Speaker Output (TB1 Terminals 7 and 8)** - Terminals 7 and 8 of TB1 provide an audio output, sufficient to drive an external 8 ohm speaker. Terminal 7 is common (SPEAKER COM), and terminal eight is positive (SPEAKER (+)). The bandwidth of the output audio is 0.1 to 13.0 kHz at  $\pm 2$  dB. Output level is 1 watt minimum with less than 3% total harmonic distortion. A speaker output gain control knob is located on the front panel. A clockwise rotation of this knob results in an increase in output signal level.

Lower sideband (LSB) or upper sideband (USB) audio can be selected individually or combined, via the front panel SPEAKER switch while in the ISB detection mode, and made available at the speaker output.

**2.2.4.7.3 DC-Coupled Audio Output (TB1 Terminal 9)** - Terminal 9 of TB1 provides a DC-coupled version of the audio provided at the speaker output (see **paragraph 2.2.4.7.2**).

**2.2.4.7.4 Remote Signal Strength Indicator Output (TB1 Terminal 10)** - Terminal 10 of TB1 provides an analog output representing the strength of the current detected signal which can be used to drive an external signal strength indicator. The output is a dc voltage which is a linear representation of the strength of the received signal. The output is 0 Vdc for a signal strength of -120 dBm and +5 Vdc for a signal strength of +10 dBm into a high impedance load. This signal is the same used to drive the front panel signal strength meter.

**2.2.4.7.5 Squelch Output (TB1 Terminal 11)** - Terminal 11 of TB1 provides a low impedance to ground (capable of sinking 150 mA) when the receiver's signal squelch circuitry is activated (i.e., the detected signal is above the set squelch level). This output is provided for system integration of the HF-1000. This output appears as a +5 Vdc source through a 100 k $\Omega$  impedance when signal squelch is not active.

2.2.4.7.6 **Mute Input (TB1 Terminal 12)** - Terminal 12 of TB1 is provided to accept a logic level mute input from an external source. When the input at this terminal is grounded (or driven to a CMOS logic low) all audio outputs of the receiver are disabled.

2.2.4.8 **POWER, 100-254 VAC Line Power Input (FL1J1)** - This three-prong male receptacle mates with the six-foot line power cord that is supplied with the receiver to supply the line voltage for the unit's operation. Acceptable input power is 100-254 VAC at 47 to 440 Hz. The HF-1000 requires approximately 35 watts for operation.

2.2.4.9 **PHONES, Front Panel Headphones Jack (A1J1)** - The PHONES connector located on the front panel is a 1/4-inch stereo headphones jack. Each channel of this output provides a minimum of 10 mW at less than 5% total harmonic distortion into a 600 ohm load, when the input signal is above the AGC threshold. Located beside the PHONES jack on the front panel is a volume control knob. A clockwise rotation of this knob results in an increase in headphones output signal level. When the independent sideband (ISB) detection mode is selected, the right channel provides lower sideband (LSB) audio while the left channel provides upper sideband (USB) audio. In all other detection modes, both channels provide identical signal content.

2.2.4.10 **Ground Stud** - A #10 threaded grounding stud is located on the rear panel for grounding the receiver in an equipment frame. See **Figure 2-4** for the location of this grounding stud.

## 2.2.5 CONFIGURING THE RECEIVER FOR REMOTE OPERATIONS

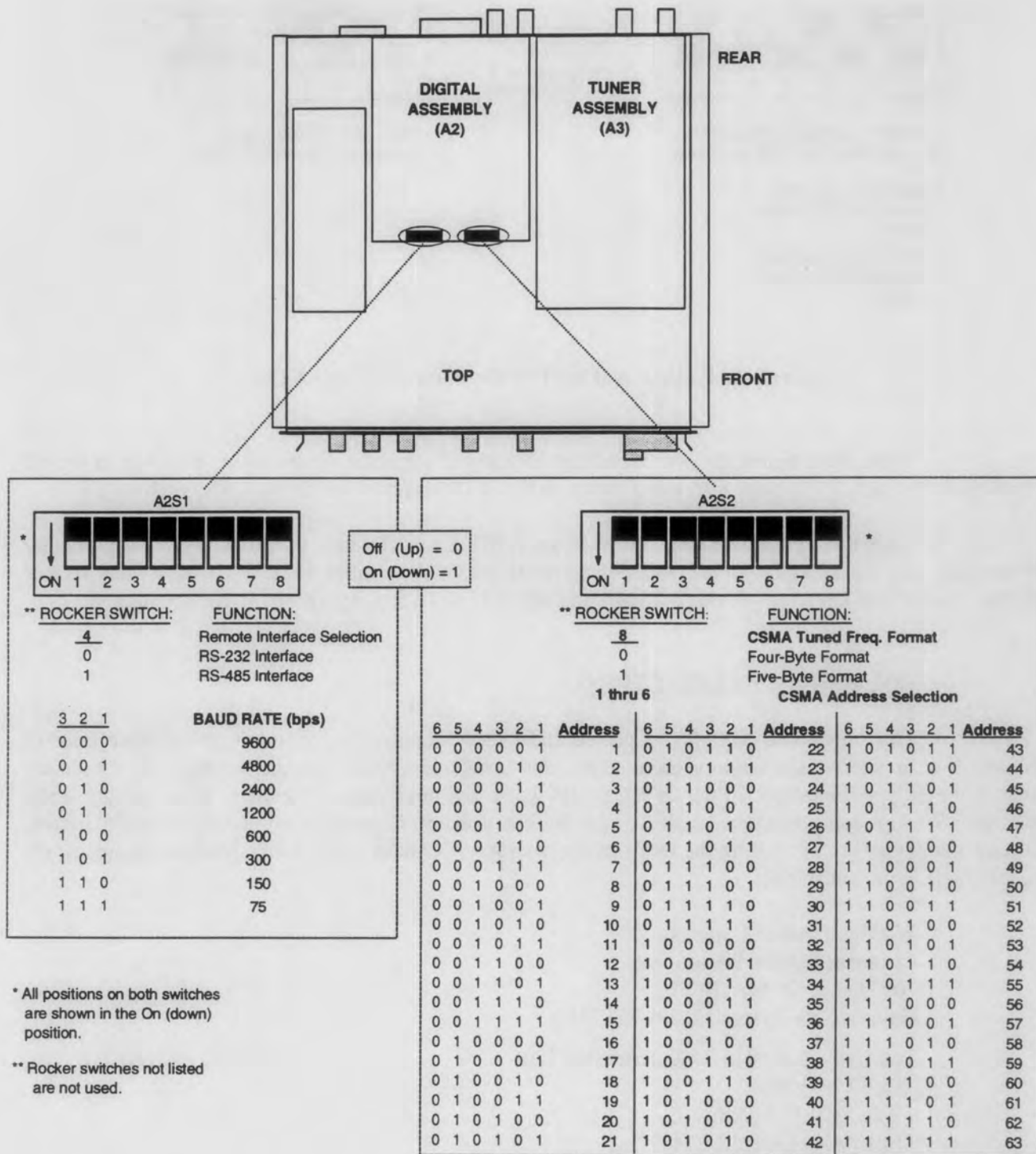
The HF-1000 contains two DIP switches that can be used to configure the receiver for remote operation. These switches are mounted on the Digital PC Assembly (A2) and are accessed by removing the receiver's top cover (see **Figure 2-5**). The switches are designated A2S1 and A2S2. Each switch contains eight rocker-type switches. The rocker switches are on when they are in the down position and are off when in the up position.

The rocker switches in A2S1 are used to enable either the RS-232C or the CSMA interface for remote operations, and to set the baud rate for the selected interface. Setting switch 4 of A2S1 to off (up) enables the RS-232C interface. Conversely, setting switch 4 to on enables the CSMA interface.

The positions of switches 1, 2, and 3 of A2S1 are used to set the baud rate for remote operations. Selectable baud rates are 75, 150, 300, 600, 1200, 2400, 4800, and 9600 bps. See **Figure 2-5** for the proper positions of switches 1, 2, and 3 of A2S1 to select the desired baud rate.

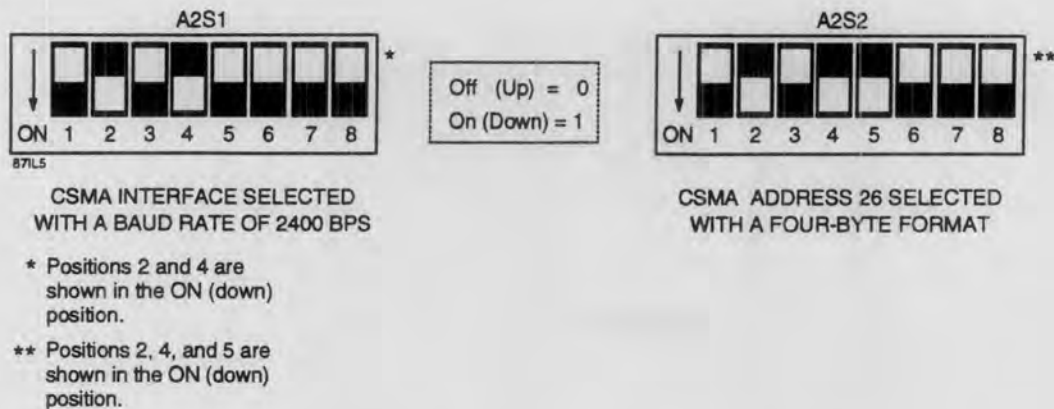
Switches 1 thru 6 of A2S2 are used to set the receiver's address on the CSMA bus during CSMA remote operations. Valid addresses are from 01 to 63 (address 00 is reserved). See **Figure 2-5** for the proper positions of switches 1 thru 6 of A2S2 to select the desired CSMA bus address. When it is desirable to have the HF-1000 emulate the ICOM R71A HF Receiver, the CSMA address should be set to 26.

Switch 8 of A2S2 is used to set the tuned frequency command and response formats on the CSMA interface to four bytes or five bytes. Setting this switch to the on (down) position selects the five-byte format and setting it to the off (up) position selects the four-byte format.



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Figure 2-5. Locating and Setting Configuration DIP Switches A2S1 and A2S2



**Figure 2-6. Examples of Set DIP Switches A2S1 and A2S2**

When determining the switch settings to achieve a specific binary value, a switch in the off (up) position corresponds to a binary 0 while a switch in the on (down) position corresponds to a binary 1.

**Figure 2-6** gives an example of switches A2S1 and A2S2 set to positions to provide particular configurations. In the example, switch A2S1 is set to select CSMA remote operation with a baud rate of 2400 bps. Switch A2S2 is set to provide a CSMA address of 26 and a four-byte tuned frequency format.

### 2.3 EQUIPMENT MALFUNCTIONS

This unit was thoroughly inspected and factory adjusted for optimum performance prior to shipment. If an apparent malfunction is encountered after installation, verify that the correct input signals are present at the proper connectors. Prior to taking any corrective maintenance action or breaking any seals, contact your Watkins-Johnson representative, or the Watkins-Johnson Company Customer Service Department to prevent the possibility of voiding the terms of the warranty. Contact the Watkins-Johnson Company via mail, telephone, wire, or cable at:

Watkins-Johnson Company  
Customer Service Department  
700 Quince Orchard Road  
Gaithersburg, Maryland 20878-1794

Toll Call: (301) 948-7550, Extension 7201  
TELEX: 89-8402  
TWX: 710-828-0546  
TELEFAX: (301) 921-9479  
EASYLINK: 62928185

If reshipment is necessary, follow the instructions in the following paragraph (Preparation for Reshipment or Storage). Do not return the equipment until a Return for Maintenance Authorization (RMA) number has been obtained from the Watkins-Johnson Company's Customer Service Department. See Item 10 in the General Terms and Conditions of Sale paper (WJ Form #WJ-151-X) for more information on equipment returns.



## 2.4 PREPARATION FOR RESHIPMENT OR STORAGE

If the unit must be prepared for reshipment, the packaging method should follow the pattern established in the original shipment. Use the best packaging materials available to protect the unit during reshipment or storage. When possible, use the original packing container and cushioning materials. If the original packing materials are not available, use the following procedures:

1. Wrap the unit in sturdy paper or plastic.
2. Place the wrapped unit in a strong shipping container and place a layer of shock-absorbing material (3/4-inch minimum thickness) around all sides of the unit to provide a firm cushion and to prevent movement inside the container.
3. If shipping the unit for service, fill out all information on the 5x6 PRODUCT DISCREPANCY REPORT card (WJ Form #WJC-QA55-0) that was provided with the original shipment. Also ensure that the Return for Maintenance Authorization (RMA) number is recorded on the card. (See **paragraph 2.3** for details on obtaining this number.) If this card is not available, attach a tag to the unit containing the following information:
  - a. Return for Maintenance Authorization (RMA) number.
  - b. The Watkins-Johnson Type/Model number of the equipment.
  - c. Serial number.
  - d. Date received.
  - e. Date placed in service.
  - f. Date of failure.
  - g. Warranty adjustment requested, yes or no.
  - h. A brief description of the discrepant conditions.
  - i. Customer name and return address.
  - j. Original Purchase Order/Contract number.
4. Thoroughly seal the shipping container and mark it FRAGILE.
5. Ship to:

Watkins-Johnson Company  
700 Quince Orchard Road  
Gaithersburg, Maryland 20878-1794  
U.S.A

When storing the equipment for extended periods, follow the above packing instructions to prevent damage to the equipment. The safe limits for storage environment are:

Temperature: -40 to +70°C  
Humidity: less than 95%

**SECTION III**  
**LOCAL OPERATION**

## SECTION III

## LOCAL OPERATION

3.1 INTRODUCTION

This section provides information related to the local operation of the HF-1000 Digital HF Receiver using its front panel controls, indicators, and displays. **Paragraph 3.2** provides details on the general use of each control, indicator, and display located on the front panel. The remaining paragraphs provide details on individual functions as listed below:

<u>Function</u>	<u>Paragraph</u>
• Turning on the Receiver .....	3.3
• Operation in the Manual Mode.....	3.5
• Storing Current Receiver Parameters in Memory .....	3.6
• Changing Receiver Parameters to Those Stored in a Memory Channel.....	3.7
• Operation in the Scan Mode .....	3.8
• Running the Built-In-Test Function (BITE) .....	3.9
• Setting Remote Operation Configurations from the Front Panel.....	3.10

Before attempting to operate the receiver, it is recommended that the operator become familiar with the capabilities of the front panel controls, indicators, and displays by reading the descriptions provided in **paragraph 3.2**.

3.2 DESCRIPTION OF CONTROLS, INDICATORS, AND DISPLAYS

The front panel of the receiver contains all of the controls, indicators, and displays that are used for local operation. **Figure 3-1** shows their locations on the front panel.

Front panel controls consist of keys, volume control knobs, parameter adjust knobs, and a tuning wheel. Indicators consist of light emitting diodes (LED's) that are located in the center of some keys and LED's that are adjacent to keys. The front panel also provides a -120 to +10 dBm signal level meter. Displays consist of three 12-character, alphanumeric displays and one 8-character numeric display.

As shown in **Figure 3-1**, three sections of the front panel have shaded backgrounds. These shaded areas are provided as an aid to the operator by grouping sets of keys within particular functional areas of receiver operations. For example, the shaded area on the far left of the front panel indicates that all keys and the display within that area are associated with Memory and Scan operations and is referred to as the Memory/Scan Section. The shaded area in the center of the front panel contains keys and displays that are associated with the auxiliary parameters of the receiver such as detection mode, IF bandwidth, squelch, etc. This area is referred to as the Auxiliary Parameter Section. The third area highlights the 16-key keypad.

The following paragraphs provide more details on the general use of each control, indicator, and display.

### 3.2.1 THE TUNED FREQUENCY DISPLAY

The tuned frequency display is an 8-character numeric display, located at the top right-hand corner of the front panel. The label **FREQUENCY MHz** is located just above it. This display shows the receiver's current tuned frequency from 00.000000 to 30.000000 MHz. In some tuned frequency edit modes, a cursor is present in one digit of the display. The cursor takes the form of a digit that is constantly changing in intensity (i.e. the digit appears to be flashing). The cursor is used in decade tuning, meaning that the digit highlighted by the cursor can be adjusted from 0 to 9 using the tuning wheel or up/down arrow keys. An example of the tuned frequency display is shown below.

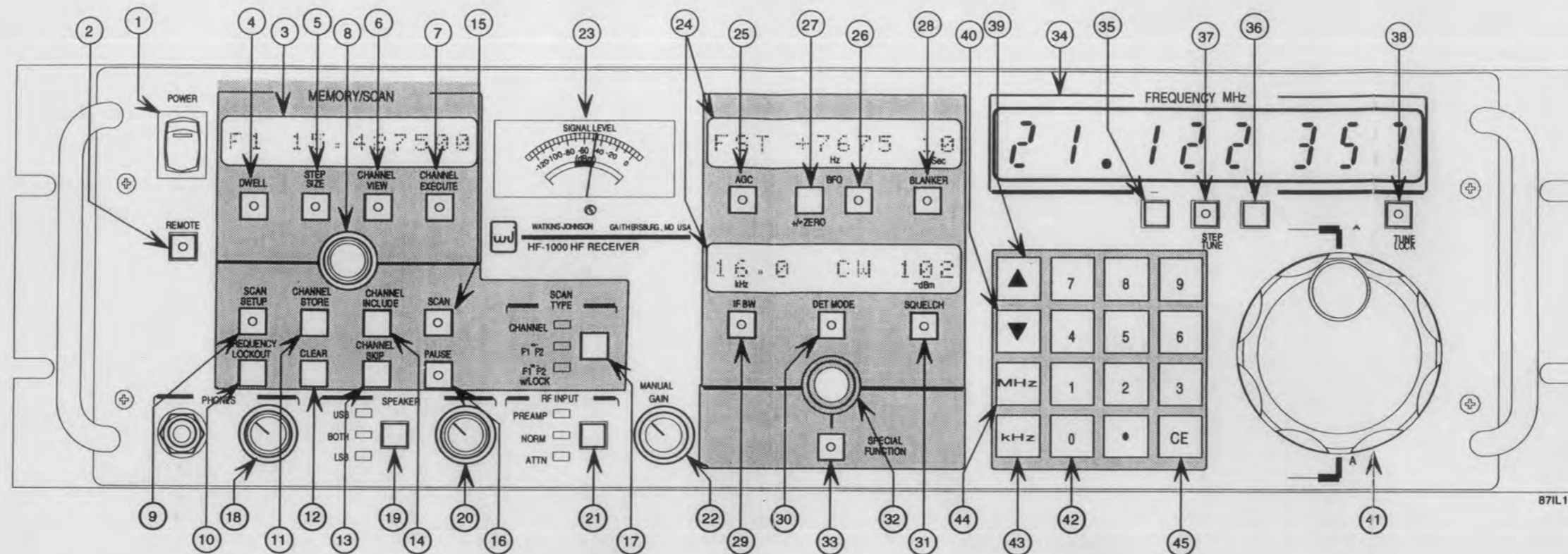
**FREQUENCY    MHz**

21 . 122 357

As seen in the example above, the display contains (from left to right) two digits, a decimal point, and six more digits. The far left digit is the 10-MHz position and the far right digit is the 1-Hz position. A number always appears in each position in the display with the exception of the 10-MHz position. The 10-MHz position is blank when the tuned frequency is 9.999999 MHz or less and the cursor is not currently on that digit. When the tuned frequency is 0.999999 MHz or less, a zero (0) is displayed in the position to the left of the decimal point (1-MHz position).

### 3.2.2 THE TUNE LOCK KEY AND LED

The function of the TUNE LOCK key is to allow the operator to "lock out" any possibility of changing the displayed tuned frequency, either intentionally or inadvertently by turning the tuning wheel or pressing the up (↑) or down (↓) arrow keys. When the tune lock function is enabled, the LED in the TUNE LOCK key is lit, the cursor disappears from the tuned frequency display, and the up/down arrow keys and tuning wheel are disabled and have no effect when used.



Item	Para. Ref.	Function	Item	Para. Ref.	Function	Item	Para. Ref.	Function	Item	Para. Ref.	Function
1	3.2.42	Turns receiver on and off.	13	3.2.31	Sets displayed channel to "skip" status for scans.	26	3.2.15	Enables adjustment of BFO frequency when lit and in CW detect mode.	38	3.2.2	Disables the tuning wheel and up and down arrow keys. Controls disabled when lit.
2	3.2.41	Places receiver in and out of Remote mode. LED lit when in Remote.	14	3.2.30	Sets displayed channel to "include" status for scans.	27	3.2.16	Sets displayed BFO frequency to positive, negative, or zero.	39	3.2.5	Increases tuned frequency by incrementing the highlighted digit or by the selected step size (in Step Tune mode).
3	3.2.20	Displays memory and scan functions.	15	3.2.32	Initiates scan mode. Scan mode active when lit.	28	3.2.17	Allows adjustment or noise blanking value when lit.	40	3.2.5	Decreased tuned frequency by decrementing the highlighted digit or by the selected step size (in Step Tune mode).
4	3.2.21	Enables entry of dwell time. Activated when lit.	16	3.2.33	Pauses or resumes an active scan. Scan paused when lit.	29	3.2.11	Allows selection of IF bandwidth when lit.	41	3.2.4	Increases or decreases tuned frequency by increasing or decreasing the highlighted digit or by the selected step size (Step Tune mode).
5	3.2.22	Enables entry of step size for tuned frequency and scan. Activated when lit.	17	3.2.23	Selects the scan type. Selection indicated by lit LED.	30	3.2.12	Allows selection of detection mode when lit.	42	3.2.6	These keys (0 through 9 and decimal point) allow for entering various numeric parameters.
6	3.2.23	Allows viewing of stored channel frequencies when lit.	18	3.2.35	Adjusts headphones volume.	31	3.2.13	Allows adjustment of squelch level when lit.	43	3.2.7	Terminates a numeric entry of tuned frequency, indicating kilohertz.
7	3.2.24	Tunes receiver to parameters of selected memory channel when lit.	19	3.2.36	Selects speaker audio for ISB mode. Selection indicated by lit LED.	32	3.2.19	Adjusts enabled auxiliary parameters or special function.	44	3.2.7	Terminates a numeric entry of tuned frequency, indicating megahertz.
8	3.2.34	Adjusts displayed memory or scan parameters.	20	3.2.37	Adjusts speaker volume.	33	3.2.18	Accesses passband tuning, remote configurations, and BITE functions.	45	3.2.8	Clears an in-progress, unterminated numeric entry.
9	3.2.26	Enables a scan setup entry for the selected scan type when lit.	21	3.2.38	Selects Path for RF input. Selection indicated by LED.	34	3.2.1	Displays current tuned frequency.			
10	3.2.27	Stores current receiver frequency into lockout memory.	22	3.2.39	Adjusts gain in manual gain mode.	35	3.2.3	Moves the frequency display cursor left.			
11	3.2.28	Stores current receiver parameters in the displayed memory channel.	23	3.2.40	Displays the signal strength of the current received signal.	36	3.2.3	Moves the frequency display cursor right.			
12	3.2.29	Clears displayed lockout frequency or blanks the Memory/Scan display. Clears all lock out and memory channels when pressed 3 times.	24	3.2.10	Displays auxiliary receiver parameters and special functions.	37	3.2.9	Selects the step tuning mode. Mode is activated when lit.			
			25	3.2.14	Enables selection of gain control mode (Fast or Slow AGC, or manual) when lit.						

Figure 3-1. Front Panel Controls, Indicators and Display

### NOTE

The tuned frequency can still be adjusted with the numeric entry keys (**paragraph 3.2.6**) when the tune lock function is enabled.

#### 3.2.3 THE ← (LEFT) AND → (RIGHT) ARROW KEYS

The ← (left) and → (right) arrow keys are located just below the tuned frequency display. The keys have no LED's and are used to move the cursor position in the tuned frequency display. The following are general guidelines to remember when using these keys.

- Pressing either ← or → while the TUNE LOCK LED is lit causes it to extinguish and the tune lock function to be disabled. The cursor in the tuned frequency display appears in the position to which it was previously set.
- Pressing either ← or → while the STEP TUNE LED is lit causes it to extinguish and the Step Tune mode to be exited. The cursor in the tuned frequency display appears in the position to which it was previously set.
- The ← and → keys are not functional while the receiver is actively scanning (i.e. the SCAN key LED is lit and the PAUSE key LED is not lit) or if a numeric entry is in progress and not terminated.
- The ← and → keys move the highlighted digit of the tuned frequency display left and right, respectively, with the following restrictions:
  - 1) the → key has no effect when the highlighted digit is in the 1-Hz position (far right) of the tuned frequency display,
  - 2) the ← key has no effect when the highlighted digit is in the 10-MHz position (far left) of the tuned frequency display, and
  - 3) if no digit is present in the 10-MHz position (the tuned frequency is 9.999999 MHz or less) moving the cursor to this position with the ← key causes a zero (0) to be displayed there.

#### 3.2.4 THE TUNING WHEEL

The tuning wheel is a 2-1/2 inch diameter knob located in the lower right-hand corner of the front panel. The only function of the tuning wheel is to change the receiver's tuned frequency. The following are general guidelines to remember when using the tuning wheel.

- Rotating the tuning wheel clockwise increases and rotating it counterclockwise decreases the receiver's tuned frequency in increments corresponding to the cursor highlighted digit in the tuned frequency display.

- When the Step Tune mode is enabled (STEP TUNE key LED is lit), rotating the tuning wheel clockwise increases and rotating it counterclockwise decrease the receiver's tuned frequency in units equal to the current setting of the Memory/Scan step size (see **paragraph 3.2.22**).
- The tuning wheel is not functional while the TUNE LOCK key LED is lit, while the receiver is actively scanning or if a numeric entry is in progress and not terminated.
- The receiver's tuned frequency cannot be incremented or decremented beyond the tuning range of the receiver (0.000000 to 30.000000). The display also does not "wrap around" to the other limit (i.e., it will not go from 0.000000 to 30.000000 when decrementing and will not go from 30.000000 to 0.000000 when incrementing).

### 3.2.5 THE ↑ (UP) AND ↓ (DOWN) ARROW KEYS

The ↑ (up) and ↓ (down) arrow keys are part of the 16-key keypad located below the tuned frequency display. The function of these keys is to change the receiver's tuned frequency. The following are general guidelines to remember when using these keys.

- Each press of the ↑ or ↓ keys increase or decrease, respectively, the receiver's tuned frequency in increments corresponding to the cursor highlighted digit in the tuned frequency display.
- When the Step Tune mode is enabled (STEP TUNE key LED is lit), pressing the ↑ key increases and pressing the ↓ key decreases the receiver's tuned frequency in units equal to the current setting of the Memory/Scan step size (see **paragraph 3.2.22**).
- The ↑ and ↓ keys are not functional while the TUNE LOCK key LED is lit, while the receiver is actively scanning or if a numeric entry is in progress and not terminated.
- The receiver's tuned frequency cannot be increased or decreased beyond the tuning range of the receiver (0.000000 to 30.000000). The display also does not "wrap around" to the other limit (i.e. it will not go from 0.000000 to 30.000000 when decrementing and will not go from 30.000000 to 0.000000 when incrementing).

### 3.2.6 THE NUMERIC ENTRY KEYS (0-9 AND DECIMAL POINT)

The numeric entry keys are provided to allow the operator to enter numbers for various receiver parameters instead of using edit knobs or the tuning wheel. A numeric entry can be performed as long as the receiver is not actively scanning. The following are receiver parameters that can be entered with the numeric entry keys:

- Receiver Tuned Frequency (**paragraph 3.5.1**),
- Beat Frequency Oscillator Frequency (**paragraph 3.5.7**),
- Noise Blanker Frequency (**paragraph 3.5.9**),
- Squelch Level (**paragraph 3.5.4**),
- Scan Dwell Time (**paragraph 3.8.1**),
- Scan Lockout Frequency (**paragraph 3.8.2.3**),
- Scan Setups (**paragraph 3.8.2**),
- Step Size (**paragraphs 3.5.1, 3.8.2**), and
- Memory Channel View, Channel Store, Channel Skip, Channel Include (**paragraphs 3.6, 3.7, 3.8**).

Refer to the appropriate paragraphs listed above for the exact use and limitations when using these keys for numeric entries. In all cases however, when a numeric key is pressed the respective number appears in the right-most digit of the frequency display. Pressing another numeric key causes that number to be displayed and causes the previous number to shift one character to the left. Once the entire numeric entry is displayed, a terminator key is pressed to enter the new parameter into the receiver.

The following keys are valid terminator keys for numeric entries:

MHz key  
kHz key  
SQUELCH key  
BFO key  
BLANKER key  
IF BW key  
SPECIAL FUNCTION key  
DWELL key  
STEP SIZE key  
CHANNEL VIEW key  
SCAN SETUP key  
FREQUENCY LOCKOUT key  
CHANNEL STORE key  
CHANNEL INCLUDE key  
CHANNEL SKIP key  
CHANNEL EXECUTE key



If any other key is pressed while an unterminated numeric entry is in progress, the Memory/Scan display on the front panel is overwritten and appears as follows:

**MEMORY/SCAN**

**INVALID TERM**

indicating that the wrong terminator key was pressed for the numeric information that was displayed. If a numerical entry is out of the parameter range associated with the terminator key, the Memory/Scan display is overwritten and appears as follows:

**MEMORY/SCAN**

**OUT OF RANGE**

indicating that the entry is out of range. All of the above messages will be displayed for three seconds. After that time the displays will return to display the information that was present before the invalid entry was made.

### 3.2.7 **THE kHz (KILOHERTZ) AND MHz (MEGAHERTZ) KEYS**

The kHz and MHz keys can be used as terminators for numeric entries of the receiver tuned frequency. For example, to enter a tuned frequency of 0.050000 MHz (or 50 kHz), press the 5 key, then the 0 key, and then terminate the entry by pressing the kHz key. The same concept applies to the use of the MHz key.

### 3.2.8 **THE CE (CLEAR ENTRY) KEY**

The CE key can be used to clear an unwanted, in progress, numeric entry. This key is functional only when a numeric entry has already been started and a valid terminator key has not yet been pressed. Pressing the CE key causes the entire numeric entry to be erased.

### 3.2.9 THE STEP TUNE KEY

The STEP TUNE key is used to place the front panel in the Step Tune mode. When in the Step Tune mode, the tuned frequency can be adjusted in steps that correspond to the step size previously set with the STEP SIZE key and indicated in the Memory/Scan display. (See **paragraph 3.2.22** for details on setting the step size with the STEP SIZE key.)

When the Step Tune mode is entered, the LED in the STEP TUNE key is lit. If the TUNE LOCK key LED is lit when the Step Tune mode is entered, it is turned off. If the tuned frequency display has a highlighted digit (indicating decade tuning) when the Step Tune Mode is entered, the highlighting of that digit is discontinued. Also, when the Step Tune mode is entered, the STEP SIZE key LED in the Memory/Scan section is lit. The Memory/Scan display is overwritten and appears as follows:

<b>MEMORY/SCAN</b>									
<b>STEP x x . x x x k</b>									

where xx.xxx is the step size parameter value currently in effect. The most significant digit of this display is highlighted, when the Step Tune mode is entered, indicating that it can be adjusted. Therefore, entering the Step Tune mode automatically selects the step size parameter entry mode.

### 3.2.10 THE AUXILIARY PARAMETER DISPLAYS

The Auxiliary Parameter section of the front panel contains two, 12-character alphanumeric displays. The upper display normally shows, from left to right, the gain control mode, the beat frequency oscillator (BFO) frequency, and the noise blanking interval. The lower display normally shows, from left to right, the IF bandwidth, the detection mode, and the squelch level.

### 3.2.11 THE IF BW KEY AND LED

The IF BW key is located below the lower display in the Auxiliary Parameter section. This key serves two functions: IF bandwidth select and IF bandwidth enter. IF bandwidth select identifies, from the 66 available IF bandwidth filters, those to be included as available filter choices. The IF bandwidth enter function enters the desired IF bandwidth for the receiver.

The IF bandwidth select mode is enabled by pressing the SPECIAL FUNCTION key until the upper display appears as follows:

**IF BW SELECT**

The currently selected IF bandwidth filter is displayed in the lower Auxiliary Parameter display along with the work "include" or "skip". When "include" is displayed, that bandwidth is available for selection by the receiver when in the IF bandwidth entry mode. When "skip" is displayed, the bandwidth is not available for selection by the receiver when in the IF bandwidth entry mode. While in the IF bandwidth select mode, each press of the IF BW key toggles the status of the displayed IF bandwidth filter between "include" and "skip". Any or all of the 66 available IF bandwidth filters (see Table 1-1) can be included or skipped as desired. The status of each IF bandwidth filter can be viewed in the lower Auxiliary Parameter edit knob. To exit the IF bandwidth select mode, press any other Auxiliary Parameter key, extinguishing the IF BW key and SPECIAL FUNCTION key LEDs.

The IF bandwidth entry mode is enabled by pressing the IF BW key, illuminating the IF BW key LED. The currently selected IF bandwidth is displayed on the lower Auxiliary Parameter display. Each press of the IF BW key steps through the choices of available IF bandwidth filters. Only those IF bandwidth filters that were included for selection using the IF bandwidth select function are available. The IF bandwidth can also be adjusted with the Auxiliary Parameter edit knob when in the IF bandwidth entry mode. The IF bandwidth entry mode can be exited by pressing any other Auxiliary Parameter key, extinguishing the IF BW key LED.

### 3.2.12 THE DET MODE KEY AND LED

The DET MODE key is located below the lower display in the Auxiliary Parameter section. This key is used to enter the receiver's detection mode. The detection mode entry mode is enabled when the DET MODE key LED is lit. The current selected detection mode is displayed on the lower Auxiliary Parameter display. Each press of the DET MODE key steps through the choices of detection modes: AM, SAM, FM, CW, LSB, USB, and ISB. If the current displayed detection mode is ISB, pressing the key again causes the AM detection mode to be displayed. The detection mode can also be adjusted with the Auxiliary Parameter edit knob when in the detection mode entry mode. The detection mode entry mode can be exited by pressing any other Auxiliary Parameter key, extinguishing the DET MODE key LED.

### 3.2.13 THE SQUELCH KEY AND LED

The SQUELCH key is located below the lower display in the Auxiliary Parameter section. This key is used to allow the entry of the receiver's squelch level or to turn it off. The squelch parameter entry mode is enabled when the SQUELCH key LED is lit. The squelch parameter can be any value from 0 to -135 dBm or off. The squelch value is displayed in the lower Auxiliary Parameter display. (Note: The negative sign (-) is not displayed.) If the squelch parameter is a numeric value when the squelch parameter entry mode is enabled, the 10-dBm digit is highlighted indicating the entry resolution. Pressing the SQUELCH key

again causes the 1-dBm digit to be highlighted. Pressing the key one more time causes "- - -" to be displayed meaning the squelch is off. Pressing the key while "- - -" is displayed causes the last entered numeric squelch parameter to be displayed, with the 10-dBm digit highlighted. The squelch value can be adjusted with the numeric entry keys or the Auxiliary Parameter edit knob (refer to **paragraph 3.2.19**). The squelch parameter entry mode can be exited by pressing any other Auxiliary Parameter key, extinguishing the SQUELCH LED.

### 3.2.14 THE AGC KEY AND LED

The AGC key is located below the upper display in the Auxiliary Parameter section. This key is used to set the gain control mode of the receiver. When the gain control entry mode is active, the LED in the key is lit. The upper Auxiliary Parameter display shows the current gain control setting. Each press of the AGC key steps through the possible choices of FST (AGC fast), MED (AGC medium), SLO (AGC slow), or manual gain. When manual gain is selected, the numeric gain value of 000 to 127 dB can be adjusted with the MANUAL GAIN knob (refer to **paragraph 3.2.39**). If the displayed mode is manual gain, pressing the key again causes FST to be displayed. The gain control mode can also be adjusted with the Auxiliary Parameter edit knob when in the gain control entry mode. The gain control entry mode can be exited by pressing any other Auxiliary Parameter key, extinguishing the AGC LED.

### 3.2.15 THE BFO KEY AND LED

When the CW detection mode is selected, a beat frequency oscillator (BFO) frequency can be entered. The BFO key is used to allow the entry of the BFO frequency. This key is located below the upper display in the Auxiliary Parameter section. When the BFO entry mode is enabled, the BFO key LED is lit. The current BFO frequency is displayed in the upper Auxiliary Parameter display. The BFO entry can be any frequency from +8000 to -8000 Hz. When the BFO entry mode is entered, the 1-kHz digit of the frequency is highlighted indicating the resolution. Each successive press of the BFO key causes the cursor to shift one digit to the right. If the cursor is present in the 10-Hz position when the key is pressed, the cursor wraps around to the 1-kHz digit. The BFO frequency can be entered with the Auxiliary Parameter edit knob or the numeric entry keys. When numeric entry keys are used, pressing the BFO key terminates the numeric entry. The BFO entry mode can be exited by pressing any other Auxiliary Parameter key, extinguishing the BFO key LED.

### 3.2.16 THE +/- ZERO KEY

The +/- ZERO key is located below the upper display in the Auxiliary Parameter section. This key provides three functions to alter the BFO setting when the CW detection mode is selected. These functions are listed below.

- When pressed while the displayed BFO value is positive, it changes the BFO value to negative (-).
- When pressed while the displayed BFO value is negative, it changes the BFO value to zero (0000).
- When pressed while the displayed BFO value is zero (0000), it changes the BFO value to the absolute value of the last setting (either positive or negative).

Here, "xxx" is the currently selected type of reference frequency, either INT (internal) or EXT (external). When EXT is displayed, the "nn" is either 1, 2, 5, or 10. This number indicates the frequency, in MHz, of the currently applied external reference. When INT is displayed, the "nn" is blank (the internal reference frequency is always 10 MHz).

3.2.18.8 **Selecting the AGC Threshold Feature**

The AGC Threshold feature is selected by pressing the SPECIAL FUNCTION key until the Auxiliary Parameter display appears as below:

AGC THLD ON

or

AGC THLD OFF

Turning the AUXILIARY PARAMETER EDIT knob clockwise enables the feature and turning the knob counterclockwise disables it.

The Variable AGC Threshold feature provides an adjustable AGC threshold which allows the operator to force the receiver to stay in Manual Gain Control mode until a signal exceeding a preset AGC threshold level is detected. Once this strong signal is detected, the receiver forces itself into AGC to help prevent overload and distortion.

The Variable AGC Threshold is most useful in single sideband (SSB) detection mode or in the presence of severely fading signals. With the AGC disabled and the SSB signal inactive, RF noise is amplified to full scale of the audio channel. When AGC is enabled, all signals below the specified threshold are unaffected by AGC and are not brought up to full scale.

The operation of this feature can be verified by tuning to a SSB signal and slowly reducing the AGC threshold. While the strong SSB signal should sound the same, the noise between the SSB activity drops out since the receiver does not apply AGC.

### 3.2.19 THE AUXILIARY PARAMETER EDIT KNOB

The Auxiliary Parameter Edit knob is located just above the SPECIAL FUNCTION key in the Auxiliary Parameter section of the front panel. This knob can be used to alter various auxiliary parameters of the receiver when certain conditions are met. The following are the functions provided by the Auxiliary Parameter edit knob.

- Gain Control:** Scrolls up (clockwise) and down (counterclockwise) through gain control modes when the AGC key LED is lit (**paragraph 3.2.14**). The available gain control modes are FST (AGC fast), MED (AGC MED), SLO (AGC slow), and manual (numeric value), in that order.
- BFO Frequency:** Increases (clockwise) and decreases (counterclockwise) the BFO frequency value in steps corresponding to the highlighted digit of the BFO display when the BFO key LED is lit (**paragraph 3.2.15**). The range of the BFO value is -8000 to +8000 Hz. Attempts to tune beyond these limits are ignored. The BFO value does not go directly from +8000 to -8000 Hz with a clockwise rotation of the edit knob (i.e. no wrap-around).
- Noise Blanker:** Increases (clockwise) and decreases (counterclockwise) the Noise Blanker value when the BLANKER key LED is lit (**paragraph 3.2.17**). The range of the noise blanker value is 1 to 10 or " - -" (off). Attempts to tune beyond these limits are ignored. Turning the edit knob counterclockwise while 01 is displayed causes " - -" to be displayed. The noise blanker value does not go directly from 10 to " - -" with a clockwise rotation of the edit knob (i.e. no wrap-around).
- IF Bandwidth:** Scrolls up (clockwise) or scrolls down (counterclockwise) through the available IF bandwidths when the IF BW key LED is lit (**paragraph 3.2.11**). The IF bandwidth selection does not go directly from the maximum to minimum bandwidth when the edit knob is turned clockwise, nor does it go directly from the minimum to maximum bandwidth when turned counterclockwise (i.e. no wrap-around).
- Detection Mode:** Scrolls up (clockwise) or scrolls down (counterclockwise) through the available detection modes when the DET MODE key LED is lit (**paragraph 3.2.12**). The selectable detection modes are AM, SAM, FM, CW, LSB, USB, and ISB, in that order. The IF detection mode selection does not go directly from ISB to AM when the edit knob is turned clockwise, nor does it go directly from AM to ISB when turned counterclockwise (i.e. no wrap-around).

- Squelch Level:** Increases (clockwise) and decreases (counterclockwise) the squelch value in steps corresponding to the highlighted digit of the squelch parameter display when the SQUELCH key LED is lit (**paragraph 3.2.13**). The range of the squelch parameter is 0 to -135 dBm or "- - -" (off). Turning the edit knob counterclockwise while 135 is displayed causes "- - -" to be displayed. Turning the edit knob counterclockwise while "- - -" is displayed has no effect. Turning the edit knob clockwise while "- - -" is displayed causes 135 to be displayed with the 10-dBm digit ("3") highlighted. Turning the knob clockwise while the maximum squelch parameter is displayed (000) does not directly step the parameter to the minimum value (-135 dBm) or "- - -".
- Passband Tuning:** Increases (clockwise) or decreases (counterclockwise) the passband tuning parameter in 100-Hz steps when the SPECIAL FUNCTION key LED is lit, the Passband Tuning mode is enabled, and the 100-Hz digit is highlighted in the passband tuning display (**paragraph 3.2.18.1**). Increases (clockwise) or decreases (counterclockwise) the passband tuning parameter in 10-Hz steps when the 10-Hz digit is highlighted in the passband tuning display.
- Tunable Notch Filter:** Increases (clockwise) or decreases (counterclockwise) the position of the tunable notch filter. The range is  $\pm 9999$  Hz in 1 Hz steps. This setting represents the position of the notch filter with respect to the tuned carrier frequency.
- AGC Threshold Feature:** Toggles the AGC Threshold feature on (clockwise) or off (counterclockwise) when the SPECIAL FUNCTION key LED is lit. The threshold gain level is controlled by the MANUAL GAIN knob.

### 3.2.20 THE MEMORY/SCAN SECTION ALPHANUMERIC DISPLAY

The Memory/Scan section of the front panel contains a 12-character alphanumeric display. This display provides information pertinent to the current setting of the Memory/Scan section controls.

### 3.2.21 THE DWELL KEY AND LED

The DWELL key is located below the alphanumeric display in the Memory/Scan section of the front panel. This key is used to enable the entry of dwell times for Scan operations. Pressing this key causes its LED to light and the dwell entry mode to be entered and displayed on the Memory/Scan display.

When the dwell entry mode is enabled, the current dwell value is shown on the display. The displayed dwell time can be any value from 0.5 to 20.0 seconds or can be infinite. If the current dwell value is numeric, the far left numeric digit is highlighted indicating resolution. Pressing the DWELL key again causes the cursor to shift one digit to the right. Pressing the DWELL key while the far right digit is highlighted causes "DWL INFINITE" to be displayed. If the key is pressed while "DWL INFINITE" is displayed, the last

numeric dwell entry is redisplayed with the far left digit highlighted. The Memory/Scan edit knob can be used to adjust the highlighted value. The DWELL key is also used as a terminator key when using numeric entry keys to enter the dwell time. Refer to **paragraph 3.8.1** for details on dwell time operation.

### 3.2.22 THE STEP SIZE KEY AND LED

The STEP SIZE key is located below the alphanumeric display in the Memory/Scan section of the front panel. This key is used to enter the step size parameter entry mode. The step size parameter serves two functions: it defines the tuned frequency increment value when the STEP TUNE key LED is lit (**paragraph 3.2.9**) and it defines the step size used in a frequency-to-frequency scan setup. The step size can also be adjusted by entering the scan setup menu with the SCAN SETUP key (**paragraph 3.2.26**).

When the STEP SIZE key is pressed, its LED becomes lit and the alphanumeric display shows the current step size with the most significant (far left) digit highlighted indicating resolution. Below is an example of the alphanumeric display in the step size entry mode:

MEMORY/SCAN

S T E P x x . x x x k

where xx.xxx is the current step size value in kHz. Pressing the key again causes the highlighted position to shift one digit to the right. Pressing the key while the least significant (far right) digit is highlighted causes the most significant digit to be highlighted. The STEP SIZE key can also be used as a terminator when using the numeric keys for entering the step size. This key is not functional while the receiver is actively scanning (i.e., the SCAN key LED is lit and the PAUSE key LED is not lit).

### 3.2.23 THE CHANNEL VIEW KEY AND LED

The CHANNEL VIEW key is located below the alphanumeric display in the Memory/Scan section of the front panel. This key is used to view the frequencies stored in the receiver's memory channels. The first press of the key causes the last viewed channel to be displayed in the Memory/Scan section alphanumeric display. The memory channel number is displayed prefixed with an "s" for skipped channels or an "i" for included channels. (Refer to **paragraph 3.2.31** for details on using the CHANNEL SKIP key and to **paragraph 3.2.30** for details on using the CHANNEL INCLUDE key.) The frequency stored in the current channel is also displayed in MHz, with 10-Hz resolution. The following is an example of the standard channel view display.

MEMORY/SCAN

i 2 6    1 8.7 5 5 0 0



If the receiver is actively performing a Channel Scan, pressing the CHANNEL VIEW key causes "SCANNING XX" to be displayed where "XX" is the current channel to which the receiver is tuned ("XX" continuously changes as the receiver moves from channel to channel). If the receiver is dwelling or if the PAUSE key is pressed, the display reverts back to the standard channel view format showing the channel number and the corresponding stored frequency.

When the standard channel view format is displayed and an unterminated numeric entry is not in progress, pressing the CHANNEL VIEW key causes the next higher channel number and its frequency to be displayed. Valid channel numbers are from 00 to 99. Pressing the CHANNEL VIEW key while channel 99 is displayed causes channel 00 to be displayed. This key can also be used as a terminator after entering a channel number with the numeric entry keys.

#### 3.2.24 THE CHANNEL EXECUTE KEY AND LED

The CHANNEL EXECUTE key is located below the alphanumeric display in the Memory/Scan section of the front panel. This key can be used to set the receiver to the parameter values stored in the displayed memory channel. If a memory channel is not visible in the alphanumeric display when the CHANNEL EXECUTE key is pressed, the Channel View mode is automatically entered, lighting the CHANNEL VIEW key LED. The receiver parameters stored in the displayed memory channel (including frequency, IF bandwidth, detection and gain modes, manual gain value, BFO setting, and squelch level) are immediately executed by the receiver. Because Channel View mode is active when the CHANNEL EXECUTE key is lit, the Memory/Scan edit knob or the CHANNEL VIEW key can be used to sequence through the stored memory channels, with the receiver executing each channel as it is displayed. Once entered, the Channel Execute mode can be exited by either pressing CHANNEL EXECUTE key again, by entering the Scan mode, or by altering a receiver parameter such that an exact match no longer exists between the displayed memory channel parameters and the receiver settings.

#### 3.2.25 THE SCAN TYPE KEY AND LEDS

The SCAN TYPE key is located in the Memory/Scan section of the front panel below the signal strength meter. Directly to the left of the key are three LED's. The LED that is lit indicates the selected scan type: CHANNEL for channel scan, F1 → F2 for start frequency to stop frequency scan, and F1 → F2 w/LOCK for start frequency to stop frequency scan with lockout frequencies bypassed. Each press of the key changes the scan type. The scan type currently selected, indicated by the lit LED, can be set up with the SCAN SETUP key (**paragraph 3.2.26**).

#### 3.2.26 THE SCAN SETUP KEY AND LED

The SCAN SETUP key is located below the alphanumeric display in the Memory/Scan section of the front panel. This key is used to set up a scan operation for the receiver. When the key is pressed, its LED lights indicating the scan setup mode is enabled, and the Memory/Scan section's alphanumeric display shows the first line of the scan setup menu. The scan setup menu displayed is dependent on the current scan type selected with the SCAN TYPE key, and indicated by the lit scan type LED. Each press of the SCAN SETUP key causes the next line of the scan type setup menu to be displayed. Pressing the SCAN SETUP key

in succession while the CHANNEL scan type LED is lit causes the alphanumeric display to scroll through the following menu items:

START CHA XX	(where XX is the current start channel)
STOP CHA XX	(where XX is the current stop channel)
DWELL XX.X s	(where XX.X is the current dwell time in seconds)
or	
DWL INFINITE	(when the dwell time is set to infinite)

Pressing the SCAN SETUP key in succession while the F1 → F2 scan type LED is lit causes the alphanumeric display to scroll through the following menu items:

F1 XX.XXXXXXX	(where XX.XXXXXXX is the current start frequency in MHz)
F2 XX.XXXXXXX	(where XX.XXXXXXX is the current stop frequency in MHz)
STEP XX.XXXk	(where XX.XXX is the current step size frequency in kHz)
DWELL XX.X s	(where XX.X is the current dwell time in seconds)
or	
DWL INFINITE	(when the dwell time is set to infinite)

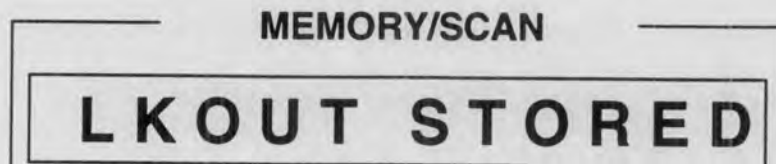
Pressing the SCAN SETUP key in succession while the F1 → F2 w/LOCK scan type LED is lit causes the alphanumeric display to scroll through the following menu items:

F1 XX.XXXXXXX	(where XX.XXXXXXX is the current start frequency in MHz)
F2 XX.XXXXXXX	(where XX.XXXXXXX is the current stop frequency in MHz)
STEP XX.XXXk	(where XX.XXX is the current step size frequency in kHz)
DWELL XX.X s	(where XX.X is the current dwell time)
or	
DWL INFINITE	(when the dwell time is set to infinite)
Lk XX.XXXXXXX	(where XX.XXXXXXX is the lowest lockout frequency in MHz)
	(each key press scrolls through the entered lockout frequencies in frequency-numeric order between F1 and F2)
Lk XX.XXXXXXX	(where XX.XXXXXXX is the highest lockout frequency in MHz)

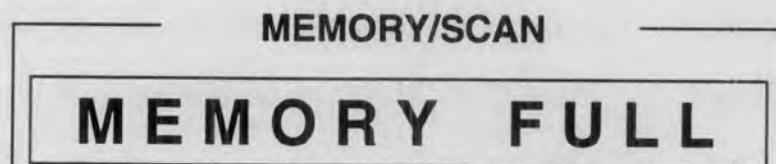
After completely scrolling through the scan setup menu, pressing the SCAN SETUP key again exits the scan setup mode. This key can also be used as numeric entry terminator when using the numeric entry keys to enter scan setup parameters. Using the key as a terminator causes the new value to appear in the Memory/Scan alphanumeric display for a period of three seconds, after which time the display automatically increments to the next menu item.

### 3.2.27 THE FREQUENCY LOCKOUT KEY

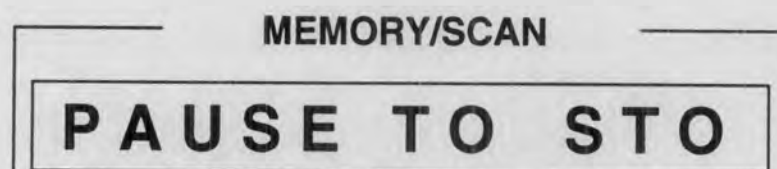
The FREQUENCY LOCKOUT key is located directly below the SCAN SETUP key in the Memory/Scan section of the front panel. The key is used to store the current receiver tuned frequency and selected IF bandwidth in one of the lockout memory locations of the receiver. Up to 100 lockout frequencies can be entered. When the FREQUENCY LOCKOUT key is pressed, the Memory/Scan alphanumeric display appears as shown below for one second.



After one second the display returns to its previous state. If an attempt is made to enter a new lockout frequency when 100 lockout frequencies are already entered, the following message is temporarily displayed:



indicating the lockout memory is full. Lockout frequencies cannot be entered with the FREQUENCY LOCKOUT key while the receiver is actively scanning. An attempt to enter a lockout frequency while the receiver is actively scanning causes the following message to be displayed for three seconds:



which indicates the scan must be paused before the lockout frequency can be entered.

### 3.2.28 THE CHANNEL STORE KEY

The CHANNEL STORE key is located below the edit knob in the Memory/Scan section of the front panel. This key is used to enter receiver parameters into one of the memory channels. If not currently in the channel view mode, the first press of the key causes the channel view mode to be entered (see **paragraph 3.2.23**) and the channel that was last stored or viewed to be shown on the Memory/Scan section alphanumeric display. Once the channel view mode is enabled, pressing the CHANNEL STORE key causes the receiver parameters to be stored in the displayed memory channel, overwriting the previous data for that memory channel. The stored parameters are tuned frequency, gain mode, manual gain level, IF bandwidth, detection mode, BFO setting, and squelch level.

### 3.2.29 THE CLEAR KEY

#### NOTE

The CLEAR key can be used to clear all lockout and channel memory. Read the following paragraphs carefully to avoid accidental deletion of stored scan parameters.

The CLEAR key is located directly below the CHANNEL STORE key in the Memory/Scan section of the front panel. This key serves several functions as listed below.

- Pressing this key while a lockout frequency is displayed in the scan setup mode (**paragraphs 3.2.26 and 3.2.27**), causes the displayed frequency to be cleared from the lockout memory.
- Pressing this key while a lockout frequency is not displayed causes the current Memory/Scan section entry mode to be exited and the alphanumeric display to be cleared.
- Pressing this key twice while a lockout frequency is not displayed causes the following message to be displayed on the alphanumeric display.

**MEMORY/SCAN**

**N E X T = C L R M E M**

- Pressing the CLEAR key while the above message is displayed clears the contents of all lockout and memory channels and causes "MEM CLEARED" to be displayed.

- Pressing the CLEAR key three times in succession (while a lockout frequency is not displayed) clears the contents of all lockout and memory channels.

### 3.2.30 THE CHANNEL INCLUDE KEY

The CHANNEL INCLUDE key is located below the edit knob in the Memory/Scan section of the front panel. Pressing this key forces the receiver into the channel view mode if not already entered. Pressing this key while in the channel view mode places the displayed channel in the "include" status. This means that when the receiver is scanning in the channel scan mode, the channel will be visited as long as it is within the start and stop channels. A channel set to the "include" status is indicated by an "i" located to the left of the channel number in the alphanumeric display. After setting a channel to the "include" status with the CHANNEL INCLUDE key, the new prefix appears in the display for three seconds. The display then automatically increments to the next higher channel number.

To place a channel in include status, enter the channel number with the numeric entry keys, and terminate the entry with the CHANNEL INCLUDE key. Groups of successive channels can be set to the "include" status by entering the lowest channel number of the group, a decimal point, and the highest channel number of the group, and terminating with the CHANNEL INCLUDE key. This action causes the display to show the highest channel number of the group prefixed with an "i" for three seconds, then automatically increments to the next higher channel number.

### 3.2.31 THE CHANNEL SKIP KEY

The CHANNEL SKIP key is located directly below the CHANNEL INCLUDE key in the Memory/Scan section of the front panel. Pressing this key forces the receiver into the channel view mode if not already entered. Pressing this key while in the channel view mode places the displayed channel in the "skip" status. This means that when the receiver is scanning in the channel scan mode, the channel will not be visited regardless if it is within the start and stop channels. A channel set to the "skip" status is indicated by an "s" to the left of the channel number in the alphanumeric display. After setting a channel to "skip" status with the CHANNEL SKIP key, the new prefix appears in the display for three seconds. The display then automatically increments to the next higher channel number.

The channel number for skip status can be entered with the numeric entry keys, terminated with the CHANNEL SKIP key. Groups of successive channels can be set to the "skip" status by entering the lowest channel number of the group, a decimal point, and the highest channel number of the group, and terminating with the CHANNEL SKIP key. This action causes the display to show the highest channel number of the group prefixed with an "s" for three seconds, then automatically increments to the next higher channel number.

### 3.2.32 THE SCAN KEY AND LED

The SCAN key is located to the right of the CHANNEL INCLUDE key in the Memory/Scan section of the front panel. This key is used to place the receiver in and out of the scan mode. When this key is pressed, its LED becomes lit and the receiver automatically begins scanning. The type of scan operation that is started is indicated by the lighting of the SCAN TYPE LEDs (refer to **paragraph 3.2.25**). The parameters of

the scan operation are dependent on the scan setup entered with the SCAN SETUP key (refer to **paragraph 3.2.26**). Pressing the SCAN key while its LED is lit causes the scan operation to be halted, the scan mode to be exited, and the LED to extinguish.

### 3.2.33 THE PAUSE KEY AND LED

The PAUSE key is located directly below the SCAN key in the Memory/Scan section of the front panel. This key is used to pause (stop) an active scan operation and is only functional while the SCAN key LED is lit. When the scan operation is paused, the PAUSE key LED is lit. The main advantage of this function is to allow the operator to immediately monitor a signal that is acquired during the scan operation, without waiting for the scan to cycle through to its stop parameter. The scan can be continued by pressing the PAUSE key again. The scan resumes at the next point in the scan and the PAUSE key LED extinguishes.

#### NOTE

Pressing the PAUSE key while its LED is lit resumes the scan operation regardless of whether or not the dwell timer has stopped. As a result, the operator can restart a scan from an unwanted acquired signal, by pressing the PAUSE key twice (once to pause the scan and again to resume the scan).

### 3.2.34 THE MEMORY/SCAN PARAMETERS EDIT KNOB

The Memory/Scan parameters edit knob is located below the STEP SIZE and CHANNEL VIEW keys in the Memory/Scan section of the front panel. This knob can be used to alter various Memory/Scan parameters of the receiver when certain restrictions are met. The following are the functions provided by the Memory/Scan parameter edit knob.

**Dwell Timer:** Increments (clockwise) or decrements (counterclockwise) the dwell timer parameter in steps corresponding to the highlighted digit of the dwell timer display when the DWELL key LED is lit (**paragraph 3.2.21**). The range of the dwell timer value is 0.5 to 20.0 seconds or can be set to INFINITE. The dwell time parameter does not go directly from DWL INFINITE to 0.5 seconds with a clockwise rotation of the edit knob (i.e., no wrap-around).

**Step Size:** Increments (clockwise) or decrements (counterclockwise) the step size parameter in steps corresponding to the highlighted digit of the step size display when the STEP SIZE key LED is lit (**paragraph 3.2.22**). The range of the step size parameter is 0.001 to 25.0 kHz. The step size parameter does not go directly from 25.0 to 0.001 with a clockwise rotation of the edit knob (i.e., no wrap-around).

- Channel Number:** Increments (clockwise) or decrements (counterclockwise) the channel number in the channel view mode when the CHANNEL VIEW key LED is lit (**paragraph 3.2.23**). The range of channel numbers is 00 to 99. Rotating the edit knob clockwise while channel number 99 is displayed causes channel number 00 to be displayed and rotating counterclockwise while 00 is displayed causes 99 to be displayed (i.e., wrap-around).
- Scan Setup:** Rotating the edit knob clockwise or counterclockwise scrolls up or down through the scan setup menu, respectively, when the SCAN SETUP key LED is lit (**paragraph 3.2.26**).

### 3.2.35 **THE PHONES OUTPUT VOLUME CONTROL KNOB**

The PHONES output volume control knob is located to the right of the PHONES jack on the bottom left-hand corner of the front panel. This knob is used to increase or decrease the volume level of the audio output on both channels of the PHONES jack. A clockwise rotation increases the volume of a nominal audio signal up to approximately 10 milliwatts and a counterclockwise rotation decreases the volume to approximately 0 milliwatt. This control is also operational while the receiver is in remote mode.

### 3.2.36 **THE SPEAKER KEY AND LEDS**

The SPEAKER key is located to the right of the PHONES output volume control knob. This key is used to select the audio to be applied to the speaker outputs on pins 7 and 8 of audio terminal block TB1, located on the rear panel, when the ISB (independent sideband) detection mode is selected. Each press of the key toggles through the available selections of USB (upper sideband), BOTH, and LSB (lower sideband), lighting the appropriate LED to the left of the key.

When USB is selected, only upper sideband audio is provided at the speaker output. When BOTH is selected, upper sideband and lower sideband audio are provided at the speaker output. When LSB is selected, only lower sideband audio is provided at the speaker output. This key has no effect on the speaker output when any detection mode other than ISB is selected.

The SPEAKER key also controls the audio available at the optional internal speaker when installed.

### 3.2.37 **THE SPEAKER OUTPUT VOLUME CONTROL KNOB**

The SPEAKER output volume control knob is located to the right of the SPEAKER key on the front panel. This knob is used to increase or decrease the volume level of the audio signal present at the speaker output on pins 7 and 8 of terminal strip TB1 located on the rear panel. A clockwise rotation increases the volume of a nominal audio signal, up to approximately 1 watt. A counterclockwise rotation decreases the volume, down to approximately 0 milliwatts. This control is operational while the receiver is in remote mode. It also is used to control the volume at the optional internal speaker when installed.

### 3.2.38 THE RF INPUT KEY

The RF INPUT key is located to the right of the SPEAKER volume control knob on the front panel. This key is used to select the path of the input RF signal, prior to being applied to any IF conversions. Each press of the key toggles through the available selections of PREAMP (preamplifier), ATTN (attenuator), or NORM (normal: neither amplified or attenuated).

Preamplifier is selected when the PREAMP LED is lit. In this selection, the input RF signal is amplified approximately 10 dB. The attenuator is selected when the ATTN LED is lit. In this selection, the RF signal is attenuated approximately 15 dB. When the NORM LED is lit, the input signal is routed in its normal path to the other circuits of the receiver.

The PREAMP selection is disabled when the receiver is tuned at or below 500 kHz. If PREAMP is selected while tuned above 500 kHz and then the receiver is tuned below 500 kHz, the preamplifier path is automatically deselected (PREAMP LED goes out) and the normal input path is automatically selected (NORM LED becomes lit). If the receiver is then tuned back above 500 kHz, the normal path is deselected (NORM LED goes out) and the preamplifier path is reselected (PREAMP LED becomes lit).

### 3.2.39 THE MANUAL GAIN CONTROL KNOB

The MANUAL GAIN control knob is located to the right of the RF INPUT key on the front panel. This control knob is used to adjust the manual gain of the receiver when the manual gain control is selected with the AGC key and the numerical gain value is displayed in the upper display of the Auxiliary Parameter section (refer to [paragraph 3.2.14](#)).

The manual gain range is from 0 to 127 dB. When this knob is set at its full counterclockwise position, minimum gain is applied to the input signal as 000 is displayed. Rotating the knob clockwise increases the gain. A full clockwise position of this knob displays 127 as the gain value and applies approximately maximum gain to the input signal.

### 3.2.40 THE SIGNAL LEVEL METER

The signal level meter is located between the Memory/Scan section and the Auxiliary Parameter section on the front panel. This meter provides an indication of the power level of the signal at the current tuned frequency. The range of the meter is from -120 to +10 dBm. It should be noted that the indication on the meter is a measurement of the input signal level before attenuation or amplification is applied via the RF INPUT key.

### 3.2.41 THE REMOTE KEY AND LED

The REMOTE key is located below the POWER switch on the top left-hand corner of the front panel. This key is used to place the receiver in and out of Remote mode of operation. The LED in the key is lit when the receiver is in remote mode. While in the Remote mode, all front panel controls are disabled except for the REMOTE key, the PHONES and SPEAKER volume control knobs, and the POWER switch. Pressing the key while the LED is lit places the receiver in Local mode and extinguishes the LED (if remote with local lockout has not been selected over the remote bus).

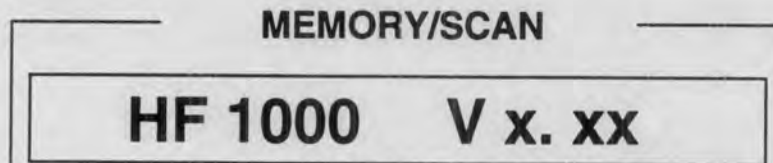


### 3.2.42 THE POWER SWITCH

The POWER switch is a rocker-type switch located on the top left-hand corner of the front panel. This switch is used to turn the receiver on and off. When the bottom-half of the switch is pushed in, the receiver is off. Pushing in on the top-half of the switch turns the unit on and starts the power-up and initialization routine (refer to **paragraph 3.3**).

### 3.3 TURNING ON THE RECEIVER

The receiver is turned on when the top-half of the POWER switch is pushed in. From the off state, turning the receiver on causes it to go into its power-up and initialization routine. During initialization, the receiver lights all front panel lights with the exception of the Memory/Scan display. This display, shown below, provides the unit (WJ8711A) and the software version (Vx.xx). The Memory/Scan display performs this in receivers with internal control software versions 1.40 and later only.



After approximately one second, initialization is complete, and the receiver automatically returns to the last selected mode, displaying the last set parameters.

The HF-1000 is equipped with battery backed-up memory. When the receiver is turned off, all current receiver parameters (including channel set-ups) are saved in memory. When the receiver is powered up, the receiver parameters that were set and displayed, prior to the receiver being turned off, are reset in the receiver and redisplayed on the displays as applicable.

#### 3.3.1 PERFORMING A COLD START AT POWER-UP

##### NOTE

When a cold start is performed at power-up, all setups in memory are cleared. All scan setups, memory channel contents, and receiver parameters are reset to their default conditions.

The receiver can be cycled through a cold start at power-up. A cold start provides a means of clearing the receiver of all previous settings saved in memory and possible front panel errors. This is performed by pressing and holding the CE (clear entry) key while turning on the receiver, then releasing the CE key. At cold start power-up the MEMORY SCAN display shows "COLD START" for approximately two seconds while clearing memory then goes through its normal initialization routine. When the power-up routine is completed, the auxiliary parameter displays and the tuned frequency window displays their default settings.

### 3.4 INTRODUCTION INTO RECEIVER OPERATIONS

To take advantage of the capabilities of the HF-1000, it is important to gain an understanding of the general concept of its operation. Two basic modes of operation are available with the receiver: the Manual mode (SCAN key LED off) and the Scan mode (SCAN key LED on).

In the Manual mode, the receiver can be tuned to different individual frequencies by the operator, in search of signals of interest. This is the basic mode of operation. Details on the functions of the receiver in the Manual mode can be found in **paragraph 3.5**.

The Scan mode is an automatic mode of operation, where the receiver can be programmed to automatically search a band of frequencies from one frequency to another, or to step through programmed memory channels. Each memory channel contains receiver parameters such as tuned frequency, detection mode, IF bandwidth, etc. As the receiver steps to each memory channel, the receiver parameters are automatically updated with those that are stored in the memory channel until the receiver steps to the next channel. **Paragraph 3.8** provides details on Scan operations.

### 3.5 OPERATION IN THE MANUAL MODE

The Manual mode is used for "manually" tuning the receiver to one frequency and monitoring it for signal activity. To properly operate the receiver in the Manual mode, the following functions and parameter adjustments should be performed.

- Enter the tuned frequency.
- Select the detection mode.
- Select an IF bandwidth.
- Adjust the headphones and/or speaker volume control(s) to a comfortable level.

After the above parameters are set, the following additional actions can be taken to enhance the receiver setup to provide optimum reception of signals of interest.

- Set the squelch level.
- Select the RF input path.
- Set the gain mode to automatic (AGC) or manual (and adjust manual gain level).
- In CW detection mode, use the beat frequency oscillator (BFO) or passband tuning functions to aid in tuning to CW signals.

- In any detection mode, use the noise blanker function to blank out impulsive interference caused by sources such as automobile ignition or over the horizon radar.
- In AM, SAM, FM, ISB, USB, or LSB mode, use the Tunable Notch Filter to aid in the reduction of unwanted signals outside the passband.

The following paragraphs provide details on entering the above parameters and using the receiver enhancement features to setup the receiver in the Manual mode for optimum performance.

### 3.5.1 ENTERING THE TUNED FREQUENCY

In the Manual mode, the receiver monitors the frequency indicated in the FREQUENCY display. This frequency can be any value from 0.000000 to 30.000000 MHz, at a resolution of 1 Hz. This means that any frequency between this range can be entered. The tuned frequency can be entered and adjusted in several ways: by the tuning wheel, the ↑ (up) and ↓ (down) keys, a numeric entry, or in the step tune mode. The following paragraphs provide more information on using these methods to enter or adjust the tuned frequency.

#### Numeric Entry:

The numeric entry keys provide for a quick means of entering a tuned frequency. When a numeric entry key is pressed, the tuned frequency display is erased and the value of the key pressed is displayed in the right most digit position. Depending on the frequency being entered, all or just the most significant digits need to be entered. For example, entering a frequency of 10 MHz only requires the following key presses:

Press 1            (the display is erased except for 1)

Press 0            (the 1 shifts left and 0 is displayed)

Press MHz        (the numeric entry is terminated and the display indicates 10.000000).

The same procedure can be used for entering frequencies in the kilohertz range by terminating the numeric entry with the kHz key. When terminating the entry this way, the decimal point is automatically displayed and a 0 is displayed in the 1-MHz position.

All numeric entries for tuned frequencies must be terminated with either the kHz or MHz key. The receiver does not tune to the entered frequency until it is terminated.

#### Tuning Wheel:

The tuning wheel can be used to dynamically adjust the tuned frequency while monitoring the audio for signals. In this tuning method, the receiver is tuning to the frequency displayed, even while the wheel is being rotated.

The tuning wheel adjusts the tuned frequency in a resolution depending on the position of the highlighted digit in the FREQUENCY display. For example, if the 1 kHz digit is highlighted, turning the wheel causes the value in that position to change. When tuning up in frequency (turning the wheel clockwise), going past 9 causes the highlighted digit to display 0 and the digit

to its left to increment by one (for example 0.009000 to 0.010000). When tuning down, the highlighted digit goes as far as 0 and the remaining digits remain unaffected (further counterclockwise rotation of the wheel is ignored). The position of the highlighted digit can be changed with the ← (left) and → (right) keys.

↑ and ↓

The ↑ (up) and ↓ (down) keys can be used when very small adjustments to the tuned frequency need to be made. These keys operate under the same principles as the tuning wheel, whereas they change only the highlighted value and the receiver dynamically tunes to the displayed frequency. Each press of the key causes the value to change by one.

Step Tune

The tuned frequency can also be adjusted in steps by using the tuning wheel or ↑(up) and ↓ (down) keys in the step tune mode. The step tune mode is enabled when the STEP TUNE key LED is lit. When enabled, the current step size is displayed in the Memory/Scan display and the cursor in the FREQUENCY display disappears.

The step size can be adjusted with the Memory/Scan edit knob. It can be any value from 0.001 kHz to 25.0 kHz. When using the ↑ and ↓ keys or the tuning wheel in the step tune mode, the tuned frequency changes in value according to the displayed step size.

### 3.5.2

#### SELECTING A DETECTION MODE

Five detection modes are available for signal demodulation: AM (amplitude modulation), SAM (synchronous amplitude modulation), FM (frequency modulation), CW (continuous wave), LSB (lower sideband), USB (upper sideband), and ISB (independent sideband). Operation with these detection modes is further described below.

- **AM Detection Mode.** In this mode, the audio present at the front panel PHONES jack and the LINE A, LINE B, SPEAKER, and DC AUDIO terminals of TB1 on the rear panel is provided by the unit's AM detector.
- **SAM Detection Mode.** Synchronous AM provides a detection mode that causes the receiver to lock on the carrier frequency in both frequency and phase. This mode improves the signal-to-noise ratio of the audio output. In addition, this mode provides greater immunity to signal loss due to fading. The operation of the receiver in the Synchronous AM Mode can be enhanced by employing the Variable AGC Threshold feature. During instances of severe fading on AM signals, the synchronous AM demodulator attempts to synchronize itself to the distorted fading signal. Loss of signal lock may occur in some cases. By using the Variable AGC Threshold feature, the operator can reduce the gain applied to the faded signal so that it will be too weak to force the synchronous AM demodulator out of lock.

- **FM Detection Mode.** In this mode, the audio present at the front panel PHONES jack and the LINE A, LINE B, SPEAKER, and DC AUDIO terminals of TB1 on the rear panel is provided by the unit's FM detector.
- **CW Detection Mode.** In this mode, the audio present at the front panel PHONES jack and the LINE A, LINE B, SPEAKER, and DC AUDIO terminals of TB1 on the rear panel is provided by the unit's CW product detector. In this mode, BFO and passband tuning operations can be used.
- **LSB Detection Mode.** In this detection mode, only IF bandwidths from 900 Hz to 3.2 kHz are selectable. Upper sideband audio is provided at the front panel PHONES jack and the LINE A, LINE B, SPEAKER, and DC AUDIO terminals of TB1 on the rear panel. The BFO frequency cannot be altered or displayed in this mode.
- **USB Detection Mode.** Except for the sideband selected, this mode is functionally identical to the LSB detection mode.
- **ISB Detection Mode.** In this detection mode, only IF bandwidths from 1.8 kHz to 3.2 kHz are selectable. Both upper and lower sidebands are separately and simultaneously demodulated. LSB audio is provided on the left channel of the PHONES jack while USB audio is provided on the right channel. USB audio is provided on the LINE A terminal of TB1 while LSB audio is provided on the LINE B terminals. The audio available at the SPEAKER terminals of TB1 is dependent on the setting of the front panel SPEAKER switch. When BOTH is selected, LSB and USB audio is combined and provided at the output. When LSB or USB are selected only the respective audio is provided at the output.

The detection mode is selected with the DET MODE key located in the Auxiliary Parameter section of the front panel. The currently selected detection mode is displayed in the lower auxiliary parameter display, directly above the DET MODE key.

To select a different detection mode, press the DET MODE key so that its LED becomes lit. Then use either the Auxiliary Parameter edit knob or continue pressing the DET MODE key until the desired detection mode is displayed.

### 3.5.3 SELECTING AN IF BANDWIDTH

Fifty-eight (58) intermediate frequency (IF) bandwidths are available for selection (see **Table 1-1** for a list of available IF bandwidths). The IF bandwidth is selected with the IF BW key located in the Auxiliary Parameter section of the front panel. The currently selected IF bandwidth is displayed in the lower auxiliary parameter display, directly above the IF BW key.

To select a different IF bandwidth, press the IF BW key so that its LED becomes lit. Then use either the auxiliary parameter edit knob or continue pressing the IF BW key until the desired IF bandwidth is displayed. Only those bandwidths that are set to "include" using the IF Bandwidth Select mode (see **paragraph 3.5.3.1**) will be available for selection.

**NOTE**

In the USB or LSB detection modes, only IF bandwidths from 900 Hz to 3.2 kHz are selectable. In the ISB detection mode, only IF bandwidths from 1.8 kHz to 3.2 kHz are selectable.

**3.5.3.1 Including an IF Bandwidth Filter for Selection**

Any of the 58 available IF bandwidth filters can be included for selection by the receiver. The IF Bandwidth Select mode is used to "include" or "skip" the desired IF bandwidth in the list of available filters.

The IF Bandwidth Select mode is enabled by pressing the SPECIAL FUNCTION key until the upper Auxiliary Parameter display appears as follows.

## IF BW SELECT

The currently selected IF bandwidth is displayed in the lower Auxiliary Parameter display along with the word "include" or "skip". When "include" is displayed, the identified bandwidth will be included in the available IF bandwidth list used for making IF bandwidth selections as described in **paragraph 3.5.3**. If "skip" is displayed, the identified bandwidth will not be available for selection.

Once in the IF Bandwidth Select mode, each of the 66 IF bandwidth filters can be set to "include" or "skip" as desired. To set a filter for "include", first select the desired IF bandwidth by rotating the Auxiliary Parameter edit knob until that bandwidth is displayed in the lower Auxiliary Parameter display. Each press of the IF BW key toggles the status of the selected filter from "include" to "skip".

**3.5.4 SETTING THE SQUELCH LEVEL**

The squelch can be adjusted to a level, depending on the strength of the signals being received. If a signal is received that is not quite strong enough for proper demodulation (i.e., its audio is unclear), the squelch level can be adjusted to block it from being applied to the audio outputs. The squelch should be set to a level where it does not block clear signals but does block noisy unwanted signals. Several adjustments may have to be made to find the optimum level. Only signals that have a power level above the set squelch level will be provided at the audio outputs.

The current squelch level is displayed in the lower auxiliary parameter display, directly above the SQUELCH key. The range of the squelch level is 0 to -135 dBm or can be set to off (" - - "). The squelch level can be adjusted by first pressing the SQUELCH key to light its LED and to enter the squelch entry mode. The value can be altered by the Auxiliary Parameter edit knob or by pressing the SQUELCH key to toggle

between off and a numeric value. The numeric entry keys can be used to enter a numeric value in units of -dBm, terminated with the SQUELCH key.

Terminal 12 (MUTE) of TB1 on the rear panel is provided for the input of external squelch control in system setups. When an external mute is asserted (mute line pulled low), the receiver's squelch is activated and the squelch value in the display is overwritten with "MUT". When the external mute is disasserted (mute line pulled high or not driven), the display returns to the last squelch value that was selected.

### 3.5.5 **ATTENUATING OR AMPLIFYING INPUT SIGNALS VIA THE RF INPUT PATH SELECTION**

Depending on the receiver's tactical location, signals may be, in general, too powerful or not powerful enough for ideal reception. In these situations the input signals can be attenuated or amplified by selecting the appropriate RF input path for the input signals. The RF INPUT key is used to make the selection, which can be PREAMP, NORM, or ATTN. The selection is indicated by the lit LED.

When PREAMP is selected, all input signals are amplified by 10 dB. When ATTN is selected, all input signals are attenuated by 15 dB. When NORM is selected, the input signals are unaffected at this point.

### 3.5.6 **SELECTING THE GAIN CONTROL MODE**

Two basic gain control modes are available: automatic (AGC) or manual. In the AGC mode, the receiver automatically adjusts the gain level (depending on the level of the received signal) to provide optimum signal level for demodulation. Two modes of AGC are available: fast or slow. The fast AGC mode provides a 15 millisecond attack time and a 25 millisecond decay time which makes it a more suitable selection when monitoring signals in the AM and FM detection modes. The slow AGC mode provides a 15 millisecond attack time and a 4 second decay time which is best suited for monitoring signals in the CW, USB, LSB, and ISB detection modes. Attack time and decay time are defined as the length of time that it takes for the audio outputs to return to a nominal level after a moderate instantaneous increase or decrease in the input signal level has occurred, respectively.

The selected gain mode is displayed in the upper Auxiliary Parameter display, directly above the AGC key. The selections are FST (for fast AGC), SLO (for slow AGC), and MAN (for manual gain control). To select the gain control mode, press the AGC key, lighting its LED. Use the Auxiliary Parameter edit knob or continue pressing the AGC key until the desired mode is displayed.

In the manual gain mode (MAN), the operator can manually adjust the gain of the receiver with the MANUAL GAIN knob.

### 3.5.7 **AIDING CW DETECTION WITH THE BFO FUNCTION**

The BFO (beat frequency oscillator) function is available, while in the CW detection mode, to aid in the detection of CW tones. A BFO frequency can be applied to the received CW signal to alter its audio pitch.

The BFO frequency ranges from -8000 Hz to +8000 Hz with 10-Hz resolution. For example, if the tone of the received CW signal is at 5,000 Hz, entering a BFO frequency of -1000 Hz would change the CW tone heard at the audio outputs to 4,000 Hz. Conversely, entering a BFO frequency of +1000 Hz would change the CW tone to 6,000 Hz.

The current BFO frequency is displayed in the upper Auxiliary Parameter display, directly above the BFO keys. To change the BFO frequency, first press the BFO key to light the LED and enable the BFO parameter entry mode. The parameter can then be adjusted with the Auxiliary Parameter edit knob or can be overwritten with a new value by using the numeric entry keys.

The +/- ZERO key is used to change the sign of the frequency to positive or negative, or can be used to automatically set the BFO to zero. Continue pressing this key until the positive (+) or negative (-) sign is displayed or until 0000 is displayed as desired.

### 3.5.8 PASSBAND TUNING IN CW DETECTION MODE

The passband tuning function is available only while the receiver is in the CW detection mode. This function has the effect of shifting the IF bandwidth without changing the frequency of the audio output signals so that unwanted CW signals can be placed outside of the IF bandwidth while keeping the wanted CW signals inside the bandwidth. This is especially useful in FSK demodulation applications for monitoring mark and space frequencies while other CW signals close in frequency are present.

The passband tuning parameter can be any value from -2000 to +2000 Hz in 10-Hz steps. When the passband tuning function is used, the tuned frequency and BFO frequencies are adjusted in accordance to the entered passband tuning parameter. The BFO frequency counteracts the effect of the tuned frequency, which allows the output audio tones to remain at the previously adjusted frequencies. For example, entering a passband tuning parameter of +1000 shifts the tuned frequency up by 1000 Hz which also shifts the IF bandwidth. Any signals received within the IF bandwidth are applied with a BFO offset frequency of -1000 Hz which brings the demodulated tone back down to its original audio frequency.

The passband tuning mode is entered by pressing the SPECIAL FUNCTION key until the upper Auxiliary Parameter display appears as follows:

<span style="font-size: 24pt; font-weight: bold;">P B T U N</span> <span style="font-size: 24pt; font-weight: bold;">s</span> <span style="font-size: 24pt; font-weight: bold;">n n n n</span>
<span style="font-size: 18pt;">Hz</span> <span style="margin-left: 150px;"><span style="font-size: 18pt;">mSec</span></span>

where "s" is the positive (+) or negative (-) sign and "nnnn" is the offset frequency. The Auxiliary Parameter edit knob can be used to adjust the parameter.



**NOTE**

The passband tuning parameter is reset to zero (0000) when the CW detection mode is deselected or whenever the tuned frequency is changed while the passband tuning parameter is not currently displayed.

**3.5.9 BLANKING OUT NOISE INTERFERENCE**

The HF-1000 is equipped with a noise blanker function. This function can be used to "blank" impulsive interference at the tuned frequency. Common interferences such as "popping" from ground radar waves can be blanked for a period of time, keeping them from being demodulated and heard at the audio outputs. The noise blanker can be any value from 1 to 10 or can be set to off. The higher the noise blanker value, the more noise blanking is applied. The noise blanker can be adjusted while listening to the received audio, and setting the noise blanker to a value that is just long enough to blank the noise but no longer.

The current noise blanker setting is displayed in the upper Auxiliary Parameter display, directly above the BLANKER key. To adjust the setting, first press the BLANKER key to light its LED and enable the noise blanker entry mode. The value can be adjusted with the Auxiliary Parameter edit knob or can be overwritten with a numeric entry, terminated by pressing the BLANKER key.

**3.5.10 USING THE TUNABLE NOTCH FILTER**

The Tunable Notch filter function is available, while in the AM, FM, USB, LSB, and ISB detection modes, to aid in the reduction of unwanted signals outside the passband. The relative position of the tunable Notch Filter can be adjusted to  $\pm 9999$  Hz from the tuned carrier frequency, however, each available IF bandwidth filter has its own limits. **Table 3-1** lists the possible IF bandwidths available and their respective tunable notch filter range.

The current notch filter setting is displayed in the upper Auxiliary Parameter display.

The +/- ZERO key is used to set the relative direction above or below the carrier frequency the tunable notch filter tunes. Selections of above (>) or below (<) the tuned carrier frequency, and OFF are toggled with each press of the +/- ZERO key. Once the desired direction (>) or (<) is selected, the position of the notch filter can be adjusted with the Auxiliary Parameter edit knob, or by using the numeric entry keys.

**Table 3-1. Tunable Notch Filter Range**

IF Bandwidth (kHz)	Maximum Relative Setting from the Tuned Carrier Frequency
.056, .063, .069 .075, .081, .088 .094, .100	±97 Hz
.113, .125, .138, .150, .163, .175, .188, .200	±195 Hz
.225, .250, .275 .300, .325, .350, .375, .400	±390 Hz
.450, .500, .550, .600, .650, .700, .750, .800	±781 Hz
.900, 1.000, 1.100, 1.200, 1.300, 1.400, 1.500, 1.600	±1562 Hz
1.800, 2.000, 2.200, 2.400, 2.600, 2.800, 3.000, 3.200	±3125 Hz
3.600, 4.000, 4.400, 4.800, 5.200, 5.600, 6.000, 6.400 7.200, 8.000	±6250 Hz ±12500 Hz

**NOTE**

The HF-1000 software will allow tunable notch filter settings of ±9999 Hz in all IF bandwidths. However, settings outside the specified maximum limit for each bandwidth will automatically disable the tunable notch filter.

## 3.6

**STORING CURRENT RECEIVER PARAMETERS IN MEMORY**

The receiver parameters that are currently displayed can be stored in a memory channel of the receiver for later recall and use. The current tuned frequency and all auxiliary parameters are stored. To store the current receiver parameters, first select the Channel View mode by pressing the CHANNEL VIEW key and lighting its LED. Use the Memory/Scan edit knob, or perform a numeric entry terminated with the CHANNEL VIEW key, to display a vacant memory channel or a memory channel that has old data that can be overwritten. Unstored memory channels have a default frequency value of 20.00000 MHz.

**NOTE**

Storing receiver parameters in a memory channel overwrites its previous contents. Ensure, before storing data, that the memory channel does not contain wanted data.

Once the desired memory channel is displayed, press the STORE key. This causes the new stored frequency to be displayed for three seconds in the Memory/Scan display and the channel number to be prefixed with an "i" (example "i45 15.42700"). After three seconds, the channel number automatically increments to the next memory channel.

## 3.7

**CHANGING RECEIVER PARAMETERS TO THOSE STORED IN A MEMORY CHANNEL**

The receiver parameters can be automatically updated with receiver parameters that are stored in one of the memory channels. To perform this function, press the CHANNEL VIEW key to enter the Channel View mode. Use the Memory/Scan edit knob, or perform a numeric entry terminated with the CHANNEL VIEW key, to display the memory channel that contains the desired parameters. Once the memory channel is displayed, press the CHANNEL EXECUTE key. This lights the key's LED and updates the receiver with the parameters of the memory channel.

While the CHANNEL EXECUTE key LED is lit, the memory channel number can be changed because the Channel View mode is still enabled. (Pressing the CHANNEL EXECUTE key automatically enables the Channel View mode if not already enabled.) Changing the memory channel number while channel execute is enabled causes the receiver parameters to be automatically updated as each new channel is selected and displayed. Channel execute can be exited by pressing the CHANNEL EXECUTE key again, extinguishing its LED.

## 3.8

**OPERATION IN THE SCAN MODE**

The Scan mode is an automatic mode of operation, where the receiver can be preprogrammed to search a band of frequencies or step through individual frequencies for signal activity. Three types of scan operations are available in the Scan mode: channel scanning, frequency-to-frequency scanning, and frequency-to-frequency scanning with lockout frequencies inserted.

In the channel scan mode, the receiver is programmed to scan from a start channel to a stop channel. The channels are memory channels that contain receiver parameters, stored with the STORE key (**paragraph 3.6**). In this mode the receiver steps from channel to channel beginning with the start channel and ending with the stop channel. As the receiver steps to each channel it automatically changes its parameters to those stored in the channel. If a signal is not received in the current channel, it moves to the next channel. When the stop channel is reached, the receiver steps to the start channel and continues scanning.

In the frequency-to-frequency scan mode, the receiver is programmed to scan all frequencies between and including a start frequency and a stop frequency. If a signal is found, the scan mode stops and displays the current frequency. The amount of time the scan mode stops on a received signal is dependent on the dwell timer entry (**paragraph 3.8.1**). When the stop frequency is reached the receiver steps to the start frequency and continues scanning.

The frequency-to-frequency scan mode with lockout frequencies inserted operates identically to the frequency-to-frequency scan mode. However, in this mode the operator can enter frequencies that are to be passed over during the scan sequence and not searched for signal activity. These frequencies are referred to as lockout frequencies.

The following paragraphs provide details on the use of the dwell timer, entering scan setups, starting scans, and stopping scans.

### 3.8.1 USING THE DWELL TIMER

The dwell timer provides the operator with a means of controlling the time the receiver remains tuned on a signal received in the Scan mode before moving to the next frequency or channel. The dwell timer is activated when a signal that has a power level above the set squelch level is received.

The dwell timer can be set to any value from 0.5 to 20.0 seconds or can be set to infinite. When the timer expires, the scan operation automatically resumes whether or not the signal is still above squelch. When the timer is set to infinite, the receiver continues to dwell on the signal until either it drops below the squelch level for a period of eight seconds or until the operator manually restarts the scan.

If the signal drops below the squelch level for a period of eight seconds while the timer is activated, the scan automatically resumes regardless if the timer has not yet expired.

The dwell timer value can be entered in the scan setup menu (**paragraph 3.8.2**) or can be adjusted during an active scan with the DWELL key. When using the DWELL key to adjust the value, the dwell timer value is automatically adjusted in the setup menu for the current active scan.

### 3.8.2 SCAN SETUPS

Prior to initiating the Scan mode, a scan setup must be entered. To enter a scan setup, first press the SCAN SETUP key to enable the scan setup entry mode. This mode is enabled when the LED in the SCAN SETUP key is lit. A line item of the current scan type setup menu is displayed in the Memory/Scan display. The scan type setup menu that is displayed is dependent on the lighting of the SCAN TYPE LEDs.

Three scan type setups menus are available: channel (CHANNEL SCAN TYPE LED lit), frequency-to-frequency (F1 → F2 SCAN TYPE LED lit), and frequency-to-frequency with lockout frequencies inserted (F1 → F2 w/LOCK SCAN TYPE LED lit). The following paragraphs provide details on these scan setups.

### 3.8.2.1 CHANNEL Scan Setup

Channel scan setups can be entered when the SCAN SETUP key LED is lit and the CHANNEL SCAN TYPE LED is lit. In this setup menu, three items can be entered: the start channel, the stop channel, and the dwell time.

**Start Channel:** The start channel entry signifies the lowest channel number of the setup. To enter the start channel, first use the edit knob or press the SCAN SETUP key until "START CHA xx" is displayed. The xx is replaced with the current start channel number. Use the numeric entry keys to enter the new start channel and terminate with the SCAN SETUP key.

**Stop Channel:** The stop channel entry signifies the highest channel number of the setup. To enter the stop channel, first use the edit knob or press the SCAN SETUP key until "STOP CHA xx" is displayed. The xx is replaced with the current stop channel number. Use the numeric entry keys to enter the new stop channel and terminate with the SCAN SETUP key.

**Dwell Time:** The dwell timer value (**paragraph 3.8.1**) can be set in the channel scan setup menu. To enter the dwell timer value, first use the edit knob or press the SCAN SETUP key until the dwell timer menu item is displayed. The menu item may appear as "DWL INFINITE" or "DWELL xx.x s" where xx.x is the current dwell timer value in seconds. Use the numeric entry keys to enter the dwell timer value and terminate with the SCAN SETUP key. The dwell timer cannot be set to DWL INFINITE in the scan setup menu; use the DWELL key.

Each channel in the scan setup should be designated with an "include" or "skip" status. If all channels within the scan setup are to be scanned they should be in the "include" status. The "include" status for a channel is indicated by the channel number being prefixed with "i". If the channel within the scan setup is not to be scanned, it should be set to the "skip" status. The "skip" status for a channel is indicated by the channel number being prefixed with an "s". Use the channel view mode to review the status of each channel within the scan setup. Use the CHANNEL SKIP key or the CHANNEL INCLUDE key to select the desired status when the channel is displayed.

**Figure 3-2** provides an example of setting up and executing a channel scan operation.

**LOCAL OPERATION**

**1. STORING CHANNELS IN MEMORY**

The following steps are an example of the procedure necessary to store parameters in a memory channel for use during a channel scan operation. Three memory channels are loaded with data: 10, 11, and 20. Channel 10 is stored first with parameters such as a 6 kHz IF bandwidth, AM detection mode, -95 dBm squelch level, the fast AGC mode, and a frequency of 1.5 MHz. Channel 11 is stored next and contains the same parameters as channel 10 except it has a frequency of 1.6 MHz. Channel 20 has the same parameters as channel 10 except its threshold is set at -80 dBm and has a frequency of 15 MHz.

PROCEDURE	CONTROL ACTIONS	DISPLAY REACTION
A. Select the 6 kHz IF bandwidth by pressing the IF BW key and rotating the Auxiliary Parameter Edit Knob.	IF BW <input type="checkbox"/> (Aux. Param. Edit Knob)	6.0 AM --- kHz -dBm
B. Select the AM detection mode.	DET MODE <input type="checkbox"/> (Aux. Param. Edit Knob)	6.0 AM --- kHz -dBm
C. Set the squelch level to -95 dBm.	9 5 SQUELCH <input type="checkbox"/>	6.0 AM 095 kHz -dBm
D. Set AGC to the fast mode.	AGC <input type="checkbox"/> (Aux. Param. Edit Knob)	FST --- Hz
E. Enter a frequency of 1.5 MHz then store the frequency and auxiliary parameters in channel 10.	1 . 5 MHz 1 0 CHANNEL STORE <input type="checkbox"/>	FREQUENCY MHz 1.500 000 MEMORY / SCAN i10 01.500000 ↓ MEMORY / SCAN s11 20.000000

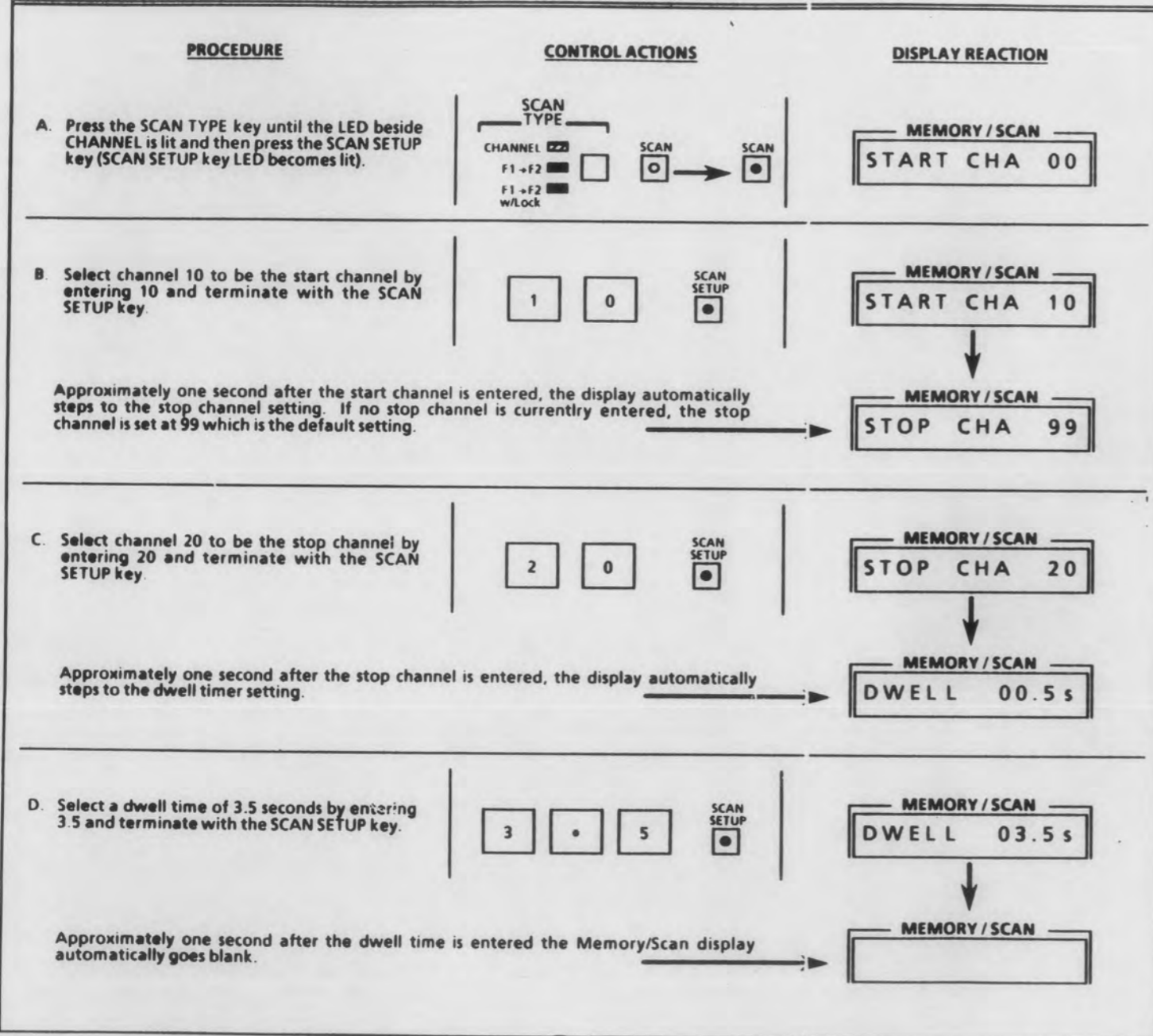
Storing a frequency in a channel automatically sets the channel to the include status as indicated by the "i" to the left of the channel number. Approximately one second after the frequency is stored in channel 10, the display automatically steps to channel 11.

PROCEDURE	CONTROL ACTIONS	DISPLAY REACTION
F. Enter a frequency of 1.6 MHz then store the frequency and current auxiliary parameters in channel 11.	1 . 6 MHz CHANNEL STORE <input type="checkbox"/>	FREQUENCY MHz 1.600 000 MEMORY / SCAN i11 01.600000 ↓ MEMORY / SCAN s12 20.000000
G. Reset the squelch level to -80 dBm.	8 0 SQUELCH <input type="checkbox"/>	6.0 AM 080 kHz -dBm
H. Enter a frequency of 15 MHz then store the frequency and auxiliary parameters in channel 20.	1 5 MHz 2 0 CHANNEL STORE <input type="checkbox"/>	FREQUENCY MHz 15.000 000 MEMORY / SCAN i20 15.000000 ↓ MEMORY / SCAN s21 20.000000

Figure 3-2. Example of a Channel Scan Operation (Sheet 1 of 3)

**2. SET UP THE CHANNEL SCAN OPERATION**

The following steps are an example of the procedure necessary to set up the receiver for a channel scan operation. In the example, channel 10 is selected as the start channel and channel 20 is selected as the stop channel. The dwell time is set to 3.5 seconds. In this setup, channels 10, 11, and 20 are visited in the scan and channels 00 thru 09, 12 thru 19, and 21 thru 99 are skipped.



**3. EXECUTING THE CHANNEL SCAN**

The following steps are an example of the procedure necessary to execute a channel scan. The first step initiates the channel view mode (optional). The scan is then started.

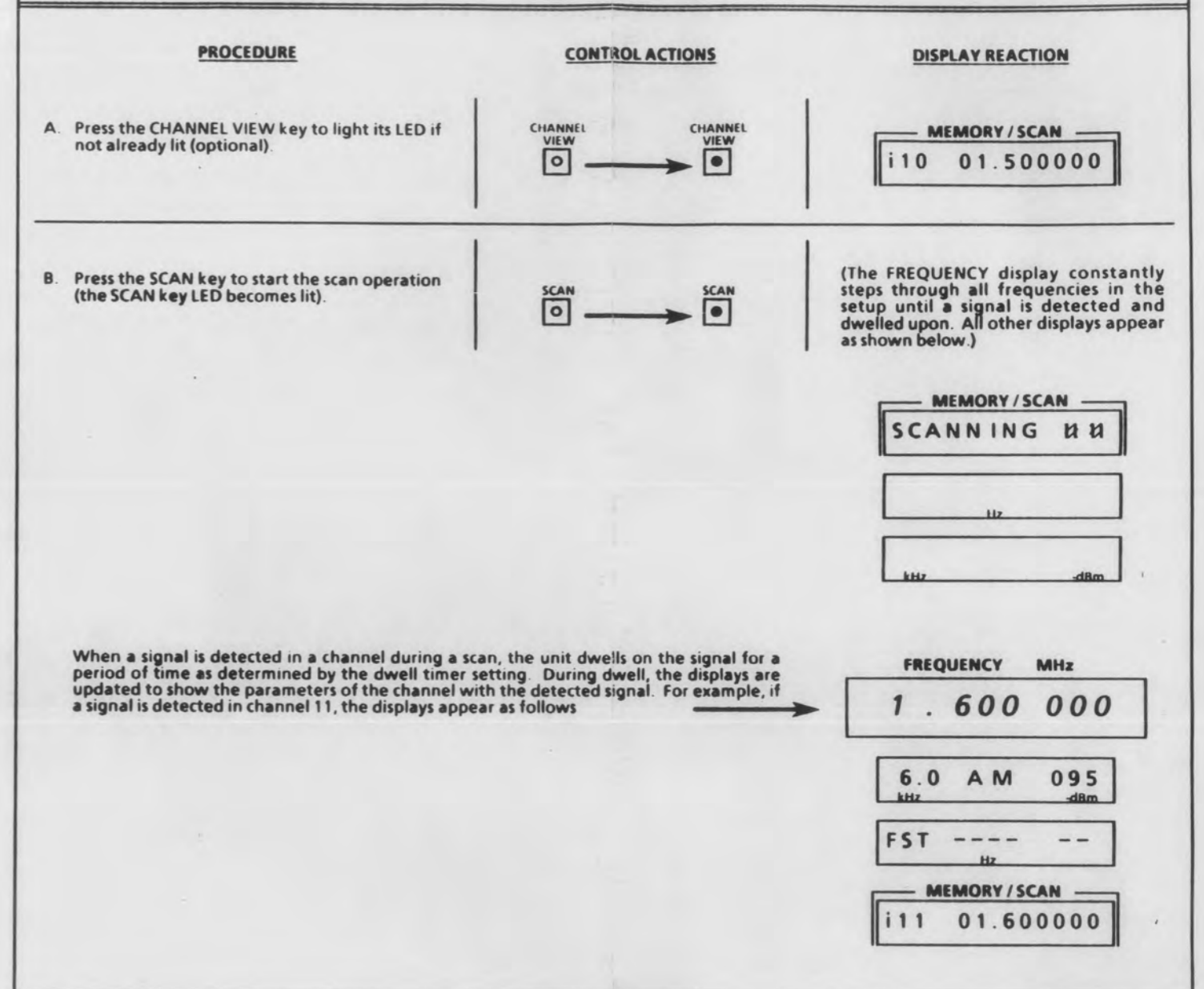










Figure 3-2. Example of a Channel Scan Operation (Sheet 2 of 3)

**4. SKIPPING A CHANNEL DURING CHANNEL SCAN EXECUTION**

The following steps are an example of the procedure necessary to skip a channel during channel scan. The first step pauses the scan. The next steps select channel 20 to be viewed and set to the skip status. The scan is then restarted.

PROCEDURE	CONTROL ACTIONS	DISPLAY REACTION
A. Press the PAUSE key to stop the scan. The PAUSE key LED should become lit; if the CHANNEL VIEW key LED is not lit, press the key so its LED becomes lit.	 → 	(The displays show the parameters of the channel that was accessed when the scan was stopped.)
B. Select channel 20 by entering 20 and terminate with the CHANNEL VIEW key.	  	<div style="border: 1px solid black; padding: 2px; display: inline-block;">                     MEMORY / SCAN                      i20 15.000000                 </div>
C. Lockout channel 20 by pressing the CHANNEL SKIP key.		<div style="border: 1px solid black; padding: 2px; display: inline-block;">                     MEMORY / SCAN                      s20 15.000000                 </div> <div style="text-align: center;">↓</div> <div style="border: 1px solid black; padding: 2px; display: inline-block;">                     MEMORY / SCAN                      s21 20.000000                 </div>
D. Restart the scan operation by pressing the PAUSE key.	 → 	<div style="border: 1px solid black; padding: 2px; display: inline-block;">                     MEMORY / SCAN                      SCANNING ± ±                 </div>

**5. INCLUDING A CHANNEL DURING CHANNEL SCAN EXECUTION**

The following steps are an example of the procedure necessary to include a channel during channel scan. The first step pauses the scan. The next steps select channel 20 to be viewed and set to the include status. The scan is then restarted.









PROCEDURE	CONTROL ACTIONS	DISPLAY REACTION
A. Press the PAUSE key to stop the scan. The PAUSE key LED should become lit; if the CHANNEL VIEW key LED is not lit, press the key so its LED becomes lit.	 → 	(The displays show the parameters of the channel that was accessed when the scan was stopped.)
B. Select channel 20 by entering 20 and terminate with the CHANNEL VIEW key.	  	<div style="border: 1px solid black; padding: 2px; display: inline-block;">                     MEMORY / SCAN                      s20 15.000000                 </div>
C. Set channel 20 to the include status by pressing the CHANNEL INCLUDE key.		<div style="border: 1px solid black; padding: 2px; display: inline-block;">                     MEMORY / SCAN                      i20 15.000000                 </div> <div style="text-align: center;">↓</div> <div style="border: 1px solid black; padding: 2px; display: inline-block;">                     MEMORY / SCAN                      s21 20.000000                 </div>
D. Restart the scan operation by pressing the PAUSE key.	 → 	<div style="border: 1px solid black; padding: 2px; display: inline-block;">                     MEMORY / SCAN                      SCANNING ± ±                 </div>

Figure 3-2. Example of a Channel Scan Operation (Sheet 3 of 3)



### 3.8.2.2 Frequency-to-Frequency (F1 → F2) Scan Setup

Frequency-to-Frequency scan setups can be entered when the SCAN SETUP key LED is lit and the F1 → F2 SCAN TYPE LED is lit. In this setup menu, four items can be entered: the start frequency, the stop frequency, the step size, and the dwell time.

- Start Frequency:** The start frequency entry signifies the first frequency of the scan sequence. To enter the start frequency, first use the edit knob or press the SCAN SETUP key until "F1 xx.xxxxxx" is displayed. The xx.xxxxxx is replaced with the current start frequency in MHz. Use the numeric entry keys to enter the new start frequency and terminate with the SCAN SETUP key.
- Stop Frequency:** The stop frequency entry signifies the last frequency of the scan sequence. To enter the stop frequency, first use the edit knob or press the SCAN SETUP key until "F2 xx.xxxxxx" is displayed. The xx.xxxxxx is replaced with the current stop frequency in MHz. Use the numeric entry keys to enter the new stop frequency and terminate with the SCAN SETUP key.
- Step Size:** The step size entry determines the frequency steps in the scan. The step size can be any value from 0.001 to 25.0 kHz. To enter the step size, first use the edit knob or press the SCAN SETUP key until "STEP xx.xxxk" is displayed. The xx.xxx is replaced with the current step size in kHz. Use the numeric entry keys to enter the new step size and terminate with the SCAN SETUP key.
- Dwell Time:** The dwell timer value (**paragraph 3.8.1**) can be set in the frequency-to-frequency scan setup menu. To enter the dwell timer value, first use the edit knob or press the SCAN SETUP key until the dwell timer menu item is displayed. The menu item may appear as "DWL INFINITE" or "DWELL xx.x s" where xx.x is the current dwell timer value in seconds. Use the numeric entry keys to enter the dwell timer value and terminate with the SCAN SETUP key. The dwell timer cannot be set to INFINITE in the scan setup menu; use the DWELL key.

**Figure 3-3** provides an example of setting up and executing an F1 → F2 scan operation.

### 3.8.2.3 Frequency-to-Frequency with Lockouts (F1 → F2 w/Lock) Scan Setup

Frequency-to-frequency with lockouts scan setups can be entered when the SCAN SETUP key LED is lit and the F1 → F2 w/LOCK SCAN TYPE LED is lit. This setup menu is the same as the frequency-to-frequency setup menu (**paragraph 3.8.2.2**) except a list containing up to 100 lockout frequencies is available. When scanning in this mode, all frequencies entered in the list are passed over.

A lockout frequency can be added to the list during a paused scan by setting the tuned frequency display to the desired frequency, then press the FREQUENCY LOCKOUT key. The scan setup display does not have to be entered to store a new lockout frequency. After the lockout frequency is stored, the message "LCKOUT STORED" is displayed for a period of three seconds, after which time the Memory/Scan display returns to the previous display. If no lockout channels are available (i.e., 100 lockouts are already entered), the message "MEMORY FULL" is temporarily displayed.

A lockout frequency can also be deleted from the list. To delete a lockout, scroll through the scan setup display until the lockout frequency is displayed, then press the CLEAR key.

**Figure 3-3** provides an example of setting up and executing an F1 → - F2 scan operation including steps for entering and clearing lockout frequencies.

### 3.8.3 PLACING THE RECEIVER IN SCAN MODE

Once a scan setup has been entered, the receiver can be placed into the scan mode. To start a scan, first select the type of scan with the SCAN TYPE key, then press the SCAN key. The scan is started when the SCAN key LED is lit.

#### NOTE

When the channel scan is started, both Auxiliary Parameter displays are blanked until a signal is acquired.

### 3.8.4 PAUSING AND RESTARTING SCANS

An active scan operation can be paused by pressing the PAUSE key. When the scan is paused, the PAUSE key LED is lit and the displays indicate the current tuned frequency and auxiliary parameters of the receiver. The scan can be restarted by pressing the PAUSE key again, extinguishing its LED. When a paused scan operation is restarted, the scan operation resumes at the next step in the scan sequence after which it was paused. For example, when a channel scan operation is paused, the channel to which the receiver is currently tuned is displayed. When the scan is restarted the scan resumes at the next channel in the scan sequence.

When paused, the receiver acts as if it is in the Manual mode. Receiver parameters can be adjusted to look more closely at a received signal. When a scan is restarted, tuned frequency adjustments are ignored and the scan resumes according to the programmed scan setup. However, changes and adjustments to auxiliary parameters are maintained.

Also, when paused, scan setup parameters can be changed. Lockout frequencies can be added with the FREQUENCY LOCKOUT key or can be deleted in the scan setup menu. The step size can be changed with the STEP SIZE key or in the scan setup menu.

LOCAL OPERATION

1. SET UP THE F1 → F2 SCAN

The following steps are an example of the procedure necessary to set up an F1 → F2 scan. In the example, the scan is set up with a start frequency of 530 kHz, a stop frequency of 1.6 MHz, a step size of 10 kHz, and a dwell time of 3 seconds.

PROCEDURE	CONTROL ACTIONS	DISPLAY REACTION
A. Press the SCAN TYPE key until the LED beside F1 → F2 is lit and then press the SCAN SETUP key (SCAN SETUP key LED becomes lit).		
B. Reset the start frequency to 0.53 MHz by entering .53 and terminate with the SCAN SETUP key.		
Approximately one second after the start frequency is entered, the display automatically steps to the default or previously set stop frequency setting.		
C. Reset the stop frequency to 1.6 MHz by entering 1.6 and terminate with the SCAN SETUP key.		
Approximately one second after the stop frequency is entered, the display automatically steps to the default or previously set step size setting.		
D. Enter a step size of 10 kHz by entering 10 and terminate with the SCAN SETUP key.		
Approximately one second after the step size is entered, the display automatically steps to the dwell timer setting.		
E. Select a dwell time of 3 seconds by entering 3 and terminate with the SCAN SETUP key.		
Approximately one second after the dwell time is entered, the scan setup mode is automatically exited and the Memory/Scan display goes blank.		

NOTE: the Memory Scan Edit knob can be used in the above example to jump back and forth between scan setup parameters.

2. EXECUTING THE F1 → F2 SCAN

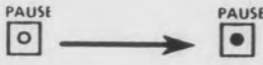
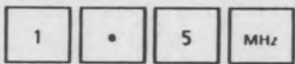

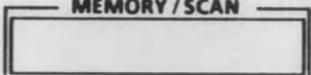
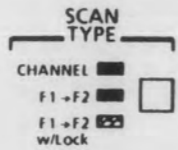

The following steps are an example of the procedure necessary to execute an F1 → F2 scan. In the example, the auxiliary parameters of the receiver are set first, such as selecting the 6 kHz IF bandwidth, AM detection mode, -95 dBm squelch level, and the fast AGC mode. Then the scan is started. Steps are also given to pause the scan, reset the squelch level to -90 dBm, and then resume the scan. The last step shows how to stop and exit the scan mode.

PROCEDURE	CONTROL ACTIONS	DISPLAY REACTION
A. Select the 6 kHz IF bandwidth.		
B. Select the AM detection mode.		
C. Set the squelch level to -95 dBm.		
D. Set AGC to the fast mode.		
E. Press the SCAN TYPE key until the LED beside F1 → F2 is lit and then press the SCAN key to start the scan (SCAN key LED becomes lit).		(The FREQUENCY display constantly steps through all frequencies in the setup until a signal is detected and dwelled upon.)
F. Press the PAUSE key to pause the scan (PAUSE key LED becomes lit).		(The FREQUENCY display shows the tuned frequency.)
G. Reset the squelch level to -90 dBm.		
H. Press the PAUSE key to restart the scan.		(The FREQUENCY display constantly steps through all frequencies in the setup until a signal is detected and dwelled upon.)
I. Press the SCAN key to stop the scan.		(The FREQUENCY display shows the tuned frequency.)

Figure 3-3. Example of an F1 → F2 Scan Operation With and Without Lockouts (Sheet 1 of 2)

### 3. LOCKING A FREQUENCY OUT OF THE F1 → F2 SCAN

The following steps are an example of the procedure necessary to lock a frequency out of an F1 → F2 scan. The first step pauses the scan. Then enter the frequency of 1.5 MHz to be locked out and press the FREQUENCY LOCKOUT key to store it. The last steps restart the scan.

PROCEDURE	CONTROL ACTIONS	DISPLAY REACTION
A Press the PAUSE key to pause the scan (PAUSE key LED becomes lit)		(The FREQUENCY display shows the current frequency.)
B Enter a frequency of 1.5 MHz by entering 1.5 and terminate with the MHz key.		<b>FREQUENCY MHz</b> 1 . 500 000
C With a frequency of 1.5 MHz currently shown in the frequency display, press the FREQUENCY LOCKOUT key to lock it out of the scan operation		<b>MEMORY / SCAN</b> LKOUT STORED ↓ <b>MEMORY / SCAN</b>
Approximately one second after the lockout frequency is entered the Memory/Scan display automatically goes blank.		
D Press the SCAN TYPE key until the LED beside F1 → F2 w/lock is lit.		(No reaction from the displays.)
E Press the PAUSE key to restart the scan.		(The FREQUENCY display constantly steps through all frequencies in the setup until a signal is detected and dwelled upon.)

### 4. VIEWING AND CLEARING A LOCKOUT FREQUENCY

The following steps are an example of the procedure necessary to view and clear stored lockout frequencies. The first step pauses the scan and selects the F1 → F2 w/lock mode so the lockouts can be viewed. Then the scan setup parameters and lockout frequencies are viewed. With the lockout frequency of 1.5 MHz displayed, it is then cleared and the scan is restarted.


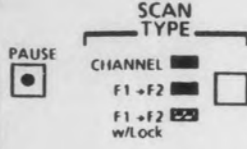
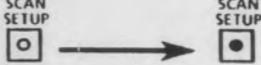




PROCEDURE	CONTROL ACTIONS	DISPLAY REACTION
A Press the PAUSE key to pause the scan (PAUSE key LED becomes lit) and then press the SCAN TYPE key until the LED beside F1 → F2 w/lock is lit.	 →  SCAN TYPE CHANNEL <input type="checkbox"/> F1 → F2 <input checked="" type="checkbox"/> F1 → F2 w/lock <input checked="" type="checkbox"/>	(The FREQUENCY display shows the tuned frequency.)
B Press the SCAN SETUP key to light its LED if not already lit.		<b>MEMORY / SCAN</b> F1 00.530000
C Continue pressing the SCAN setup key or use the Memory/Scan Edit Knob to step through and view the start frequency, stop frequency, step size, and dwell timer settings and then the stored lockout frequency(s).	 OR 	<b>MEMORY / SCAN</b> LK 01.500000
D With the undesired lockout frequency shown in the MEMORY/SCAN display, press the CLEAR key to clear it from memory.		<b>MEMORY / SCAN</b>
E Press the PAUSE key to restart the scan.		(The FREQUENCY display constantly steps through all frequencies in the setup until a signal is detected and dwelled upon.)

Figure 3-3. Example of an F1 → F2 Scan Operation With and Without Lockouts (Sheet 2 of 2)

### 3.9 RUNNING THE BUILT-IN-TEST FUNCTION (BITE)

The built-in-test function (BITE) provides the operator the capability of testing the internal circuitry of the receiver. A passed BITE test provides confidence that the receiver is performing normally.

To start BITE, first press the SPECIAL FUNCTION key until the message "BITE PENDING" is shown in the upper Auxiliary Parameter display. Then turn the Auxiliary Parameter edit knob in either direction; all LEDs are lit while BITE is being run.

The BITE result takes the form of a decimal number, equivalent to a 16-bit binary number. Sixteen tests are performed during the BITE routine. A failed test sets its corresponding bit in a 16-bit register table. The tests and their corresponding bits of the register table are listed in **Table 3-2**.

**Table 3-2. BITE Error Codes**

Bit	Decimal Value	Error Indication
0 (LSB)	1	<b>Transmit Error</b> - the control to DSP transmit pipeline is not empty.
1	2	<b>Host Download Unsuccessful</b> - the host microprocessor could not download the operating program.
2	4	<b>EPROM Download Unsuccessful</b> - the download to EPROM could not be completed.
3	8	<b>Host Command Not Acknowledged</b> - the DSP processor could not acknowledge the start-up command from the host microprocessor.
4	16	<b>No Response Back From the Host Processor</b> - the DSP processor did not receive a response back from the host microprocessor.
5	32	<b>DSP Memory Check Not Completed</b> - the check of the DSP processor's internal memory could not be completed.
6	64	<b>DSP EPROM Failure</b> - the DSP processor's internal EPROM could not be accessed.
7	128	<b>DSP SRAM Failure</b> - the DSP processor's internal static RAM could not be accessed.
8	257	<b>RF Test Failed</b> - the RF front end is not functioning properly.
9	512	<b>Host A/D Failure</b> - the host microprocessor's internal analog-to-digital converter is not functioning properly.
10	1024	<b>Non-SSB Audio Failure</b> - the AM, FM, CW demodulated audio path not functioning properly.

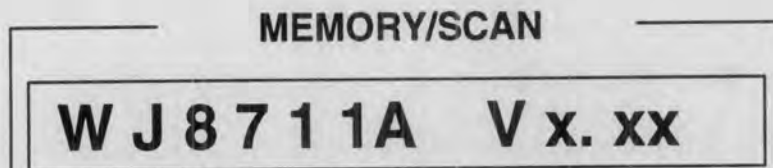
**Table 3-2. BITE Error Codes (Continued)**

Bit	Decimal Value	Error Indication
11	2048	<b>USB Audio Failure</b> - the upper sideband (USB) demodulated audio path not functioning properly.
12	4096	<b>USB Audio in LSB Path Failure</b> - the lower sideband (LSB) audio path not functioning properly with upper sideband (USB) audio.
13	8192	<b>LSB Audio Failure</b> - the lower sideband (LSB) demodulated audio path not functioning properly.
14	16384	<b>LSB Audio in USB Audio Path Failure</b> - the upper sideband (USB) audio path not functioning properly with lower sideband (LSB) audio.
15 (MSB)	32768	<b>DSP A/D Failure</b> - the DSP processor's analog-to-digital converter is not functioning properly.

The combination of set bits will determine the BITE result number. If all tests passed, the BITE result displayed will be "BITE PASS". If BITE PASS is not displayed, and error has occurred. For example, if bits 0 and 3 were set because their corresponding tests failed, the BITE result displayed will be "BITE 009" (binary equivalent 00000000 00001001). If an error is encountered, the operator may attempt to turn the receiver's power off then back on from a cold start to rerun the BITE function. If an error persists, a hardware failure has been encountered.

3.10 **DISPLAYING THE RECEIVER'S CURRENT INTERNAL CONTROL SOFTWARE VERSION**

To display the receiver's current internal control software version turn the POWER switch off and then on. The receiver goes through its initialization routine and displays the unit's current internal control software version in the Memory/Scan display. The internal control software version is displayed for approximately one second. The Vx.xx indicates the current software version.



This function is only available in units with internal control software version 1.40 and later.

### 3.11 **SETTING REMOTE OPERATION CONFIGURATIONS FROM THE FRONT PANEL**

From the front panel the local operator can select several remote operation configurations: RS-232 or CSMA remote operation selection, baud rate selection, and receiver address selection for CSMA remote operation. The following paragraphs provide details on performing these configurations.

#### **NOTE**

The receiver only recognizes remote configuration changes when power is cycled off and back on. After making any remote configuration changes, turn the receiver off then back on to set the new configuration in the receiver.

#### 3.11.1 **SELECTING THE RS-232 OR THE CSMA INTERFACE FOR REMOTE OPERATIONS**

The interface to be used for receiver remote operation can be selected from the front panel by pressing the SPECIAL FUNCTION key until the message "REMOTE xxxxx" is displayed in the upper Auxiliary Parameter display. The xxxxx is replaced with the current selection, either "RS232" or "CSMA". Use the Auxiliary Parameter edit knob to display the desired remote interface. This selection overrides the selection made with DIP switch A2S1 (see **paragraph 2.2.5**). Refer to **Section IV** of this manual for details on RS-232 remote operations or to Section V for details on CSMA remote operations.

#### 3.11.2 **SELECTING THE BAUD RATE FOR REMOTE OPERATIONS**

The baud rate for RS-232 and CSMA remote operations can be selected from the front panel by pressing the SPECIAL FUNCTION key until the message "BAUD xxxx" is displayed in the upper Auxiliary Parameter display. The available baud rates are 75, 150, 300, 600, 1200, 2400, 4800, and 9600 bps. Use the Auxiliary Parameter edit knob to display the desired baud rate. The baud rate selected applies to both RS-232 and CSMA remote operations (separate baud rate selections are not available). This selection overrides the selection made with DIP switch A2S1 (see **paragraph 2.2.5**).

#### 3.11.3 **SELECTING THE RECEIVER'S ADDRESS FOR CSMA REMOTE OPERATIONS**

The address of the receiver for CSMA remote operations can be selected at the front panel by pressing the SPECIAL FUNCTION key until the message "ADDRESS xx" is displayed in the upper Auxiliary Parameter display. The "xx" is replaced with the current address selection. The CSMA address selection is available only while CSMA is selected for remote operations (refer to **paragraph 3.11.1**).

The CSMA address for the receiver can be any number from 1 to 63 (0 is reserved). Use the Auxiliary Parameter edit knob to select and display the desired address number. This selection overrides the selection made with DIP switch A2S2 (see **paragraph 2.2.5**).

**SECTION IV**

**RS-232 REMOTE OPERATION**



## SECTION IV

## RS-232 REMOTE OPERATION

4.1 INTRODUCTION

The HF-1000 Digital HF Receiver has the built-in capability of being controlled remotely by a computer or other controller device that is equipped with an RS-232 serial interface and capable of transmitting and receiving ASCII-standard encoded characters. Physically, the controller device needs only a transmit line (TXD), a receive line (RXD), and a ground line to communicate with the receiver.

The HF-1000 can be set for RS-232 remote control by selecting "RS232" in the remote control entry mode with the front panel SPECIAL FUNCTION key. The baud rate can also be selected in an entry mode entered with this key. Refer to **paragraph 3.10** for details on using the SPECIAL FUNCTION key to configure the receiver for remote operation. Switch 4 of DIP switch A2S1 can be set to the off (up) position to activate the RS-232 remote control. A baud rate hardware default can also be selected. Refer to **paragraph 2.2.5** for details on configuring DIP switch A2S1.

Various receiver parameters can be controlled and/or monitored over the RS-232 interface. These parameters are:

- tuned frequency,
- BFO frequency,
- detection mode,
- squelch level,
- speaker type,
- IF bandwidth,
- gain mode,
- built-in-test (BITE) execution,
- error status (both current and latched),
- selection of local control, remote control, or remote control with local lockout,
- selection of F1-to-F2 scan start and stop frequencies,
- selection of channel scan start and stop channels,
- passband tuning offset frequency,
- recall stored parameters from
- tunable notch filter adjustment
- external reference,
- signal strength,
- squelch status,
- mute status,
- receiver identity,
- manual gain,
- signal dwell time,
- blanking,
- selection of channel scanning, F1-to-F2 scanning, or F1-to-F2 scanning with local lockouts,
- selection of F1-to-F2 scan increment,
- selection of frequency lockouts,
- store front panel parameters to selected memory channel, and current HF-1000 operating parameters,
- current internal control software version

This section of the manual contains all the information necessary to enable an operator to control and monitor the above receiver parameters from an RS-232 controller. Details on how to properly format and transmit remote messages and how to read responses from the receiver are provided.

Before attempting to operate the receiver remotely, it is recommended that the operator become familiar with the operation and capabilities of the receiver by viewing the information provided in **Section III** of this manual. It is also recommended that the operator become familiar with the operation of the controller by viewing its literature.

#### 4.2 INTERFACING WITH THE HF-1000

The RS-232 interface of the HF-1000 is physically implemented on the RS-232 connector (A2J3), located on the rear panel. This interface has a full duplex operation, meaning that it can transmit and receive data simultaneously. The interface is set up as a "three-wire" RS-232 configuration, implemented on the transmit data line (TXD), the receive data line (RXD), and ground. These three wires are provided at the rear panel RS-232 connector on pins 2, 3, and 7, respectively.

This interface supports software handshaking only, including XON/XOFF (receiver protocol) and ACK/NAK (transmitter protocol). Hardware handshake signals such as RTS (request to send), CTS (clear to send), DTR (data terminal ready), or DSR (data set ready) are not supported.

RS-232 serial interfaces use a method of transmitting data one bit at a time over the TXD and RXD lines. For example, an eight-bit character takes eight sequential transmissions to complete the character. In RS-232 serial transmissions, data is sent in frames (or packets). Each bit within the frame is determined by a voltage level. The voltage levels used by this interface are -8 Vdc (nominal) for a logic "1" and +8 Vdc (nominal) for a logic "0". In the inactive or quiet state, the transmit line is held at a logic 1.

The baud rate (rate of data flow in bits per second) for the HF-1000 is selectable (75, 150, 300, 600, 1200, 2400, 4800, or 9600 bps). Refer to **paragraph 3.10** for details on selecting the baud rate with the SPECIAL FUNCTION key. Switches 1, 2, and 3 of DIP switch A2S1 can be set to appropriate positions to select the hardware default baud rate. Refer to **paragraph 2.2.5** in **Section II** of this manual for details on configuring DIP switch A2S1.

The HF-1000 is set up with a fixed data word frame format consisting of ten bits, and comprised of the following:

- one start bit,
- an eight-bit character, and
- one stop bit.

It is important in serial data transmissions that the receiving device knows when data is being transferred and when data being transferred is about to stop. This information is conveyed by the above start and stop bits. The start bit synchronizes the receiving device so it reads the data properly. The stop bit notifies the receiving device that the data frame has ended. The HF-1000's fixed data word frame format does not contain a parity bit.

### 4.3 COMMAND MESSAGE FORMATTING

Command messages for the HF-1000 are exclusively ASCII-encoded data, consisting of command headers and arguments. Command headers consist of three character mnemonics. All queries consist of a command header, followed by a question mark (?). All command arguments are in the "forgiving" numerical representation form (refer to **paragraph 4.3.3**).

Command messages are divided into two categories: receiver device messages and communication messages. Refer to **paragraphs 4.4** and **4.5** respectively.

Multiple commands may be sent to the receiver at once by transmitting them as a string. All commands in the string must be separated by a semicolon (;) (i.e., DET 1;BWS 4).

#### 4.3.1 **TERMINATORS FOR COMMANDS AND QUERIES**

Terminators are used to signal the end of a command or string. When a properly formatted message is ready to be sent, a LF (line feed) character should be entered. The LF character instructs the receiver to process the preceding message(s).

The HF-1000 also transmits a terminator when responding to queries. After the query response is transmitted the receiver issues a CR,LF (carriage return, line feed characters), indicating end of response.

#### 4.3.2 **FORMATS OF QUERY RESPONSES**

The HF-1000 transmits responses to queries in a fixed-field format. Query responses begin with the three-letter mnemonic of the query in upper-case characters, followed by a numeric argument. In all query responses, the mnemonic and argument are separated by a space. Numeric arguments are represented by the least number of digits possible, while still representing the entire range of the value. If a negative value is allowed for the argument, a positive or negative sign is always given. Responses due to multiple queries are linked together in a query string, with each query and its argument separated with a semicolon from other queries in the string. The HF-1000 terminates all responses to single queries or query strings with the CR (carriage return) and LF (line feed) characters.

#### 4.3.3 **REPRESENTATION OF NUMERIC ARGUMENTS**

Arguments for commands and queries in this manual are represented by an nrX (where X is either f, 1, or 2). The nrf representation is used for command numeric arguments. The nr1 and nr2 are used for the representation of query response arguments.

Numeric arguments that are used with commands are accepted in a forgiving numeric representation (nrf). This implies that the HF-1000 is a forgiving listener. Specific details on numeric representation are given below.

- nrf - The nrf (forgiving numeric representation) data element for commands is composed of the sequential fields listed below. All fields (1-5) are optional with one restriction: at least one digit must be present with the active data element of the argument.

<u>Field</u>	<u>Data</u>
1	Plus (+) or minus (-) sign.
2	Any number of digits, up to eight.
3	A decimal point (.).
4	Any number of digits, up to eight.
5	An upper-case "E" or lower-case "e" followed by an optional sign and at least one digit but no more than two digits.

If the HF-1000 receives an nrf of a precision greater than it can handle, it rounds the number rather than truncating it. When rounding, the unit ignores the sign of the number and rounds up on values greater than or equal to one half. It rounds down on values less than one half.

- nr1 - The nr1 is a numeric query response data format for integers, composed of an optional sign field, followed by any number of digits. The decimal point is implicitly defined to always follow the last digit and is therefore, not present in the response data element.
- nr2 - The nr2 numeric response data format is composed of an optional sign field, followed by any number of digits, a decimal point, and any number of digits. At least one digit is always present on both sides of the decimal point.

## 4.4

**RECEIVER DEVICE MESSAGES**

Receiver Device Messages are commands that affect the operational parameters of the receiver. These commands are listed in **Table 4-1**.

**Table 4-1. Receiver Device Messages**

Command	Response	Description
ADV		Advance to next scan frequency. Operates when HF-1000 is in dwell mode during scan.
AGC nrf		Select gain control mode. Range: 0 - 3 Where: 0 - Manual 1 - Slow AGC 2 - Fast AGC 3 - Medium AGC
AGC?	AGC nr1	Request active gain control mode. Reset: AGC 2 Default: AGC 2 Example: AGC 0
AGD nrf nrf		Set decay time for gain control modes.  Where: 1 - Slow AGC 2 - Fast AGC 3 - Medium AGC  If Slow AGC -1000 to 5000 (rounds up to next lower 400 millisecond step) Fast AGC -10 to 100 (round to next lower 10 millisecond step) Medium AGC -100 to 1000 (round to next lower 100 millisecond step)
AGD? nrf	AGD nr1, nr1	Recall the decay time associated with the specified AGC mode.  Range: 1 - 3 AGD 1, 2000 AGD 2, 20 AGD 3, 200 Example: AGD 1, 2500 AGD 2, 20 AGD 3, 250
AGT nrf		Select AGC threshold mode (Refer to <b>paragraph 4.4.3.1.</b> ): Range: 0 - 1 Where: 0 - Off 1 - On
AGT?	AGT nr1	Request active gain control mode. Reset: AGT 0 Default: AGT 0 Example: AGT 1

**Table 4-1. Receiver Device Messages (Continued)**

Command	Response	Description
BFO nrf		Set frequency in Hz (10 Hz steps). Range: -8000 to +8000 Where: +0000 = BFO Off
BFO?	BFO nr1	Request current BFO frequency. Reset: BFO +0000 Default: BFO +1000 Example: BFO -7990
BLK nrf		Select blanking setting. Range: 0 to 10
BLK?	BLK nr1	Request active blanking setting. Example: BLK 5 Default: BLK 0
BWC nrf		Select an IF bandwidth size in Hz. Range: 0 to 08000  Note: If the value entered is not a standard IF bandwidth (see <b>Table 1-1</b> ), the standard IF bandwidth that is greater in value and closest to the requested IF bandwidth will be selected.
BWC?	BWC nr1	Request the current IF bandwidth in Hz. Reset: 06000 Default: 06000 Example: 03200

**Table 4-1. Receiver Device Messages (Continued)**

Command	Response	Description																																																																		
BWN nrf		<p>Select one of the 66 available IF bandwidth filters. Where nrf represents the filter number. The narrowest bandwidth (.056 kHz) being number 1 and the widest bandwidth (16.0 kHz) being number 66.</p> <p>Range: 001 to 058</p> <p>Where:</p> <table border="0"> <tr> <td>001 = .056 kHz</td> <td>034 = 1.00 kHz</td> </tr> <tr> <td>002 = .063 kHz</td> <td>035 = 1.10 kHz</td> </tr> <tr> <td>003 = .069 kHz</td> <td>036 = 1.20 kHz</td> </tr> <tr> <td>004 = .075 kHz</td> <td>037 = 1.30 kHz</td> </tr> <tr> <td>005 = .081 kHz</td> <td>038 = 1.40 kHz</td> </tr> <tr> <td>006 = .088 kHz</td> <td>039 = 1.50 kHz</td> </tr> <tr> <td>007 = .094 kHz</td> <td>040 = 1.60 kHz</td> </tr> <tr> <td>008 = .100 kHz</td> <td>041 = 1.80 kHz</td> </tr> <tr> <td>009 = .113 kHz</td> <td>042 = 2.00 kHz</td> </tr> <tr> <td>010 = .125 kHz</td> <td>043 = 2.20 kHz</td> </tr> <tr> <td>011 = .138 kHz</td> <td>044 = 2.40 kHz</td> </tr> <tr> <td>012 = .150 kHz</td> <td>045 = 2.60 kHz</td> </tr> <tr> <td>013 = .163 kHz</td> <td>046 = 2.80 kHz</td> </tr> <tr> <td>014 = .175 kHz</td> <td>047 = 3.00 kHz</td> </tr> <tr> <td>015 = .188 kHz</td> <td>048 = 3.20 kHz</td> </tr> <tr> <td>016 = .200 kHz</td> <td>049 = 3.60 kHz</td> </tr> <tr> <td>017 = .225 kHz</td> <td>050 = 4.00 kHz</td> </tr> <tr> <td>018 = .250 kHz</td> <td>051 = 4.40 kHz</td> </tr> <tr> <td>019 = .275 kHz</td> <td>052 = 4.80 kHz</td> </tr> <tr> <td>020 = .300 kHz</td> <td>053 = 5.20 kHz</td> </tr> <tr> <td>021 = .325 kHz</td> <td>054 = 5.60 kHz</td> </tr> <tr> <td>022 = .350 kHz</td> <td>055 = 6.00 kHz</td> </tr> <tr> <td>023 = .375 kHz</td> <td>056 = 6.40 kHz</td> </tr> <tr> <td>024 = .400 kHz</td> <td>057 = 7.20 kHz</td> </tr> <tr> <td>025 = .450 kHz</td> <td>058 = 8.00 kHz</td> </tr> <tr> <td>026 = .500 kHz</td> <td></td> </tr> <tr> <td>027 = .550 kHz</td> <td></td> </tr> <tr> <td>028 = .600 kHz</td> <td></td> </tr> <tr> <td>029 = .650 kHz</td> <td></td> </tr> <tr> <td>030 = .700 kHz</td> <td></td> </tr> <tr> <td>031 = .750 kHz</td> <td></td> </tr> <tr> <td>032 = .800 kHz</td> <td></td> </tr> <tr> <td>033 = .900 kHz</td> <td></td> </tr> </table>	001 = .056 kHz	034 = 1.00 kHz	002 = .063 kHz	035 = 1.10 kHz	003 = .069 kHz	036 = 1.20 kHz	004 = .075 kHz	037 = 1.30 kHz	005 = .081 kHz	038 = 1.40 kHz	006 = .088 kHz	039 = 1.50 kHz	007 = .094 kHz	040 = 1.60 kHz	008 = .100 kHz	041 = 1.80 kHz	009 = .113 kHz	042 = 2.00 kHz	010 = .125 kHz	043 = 2.20 kHz	011 = .138 kHz	044 = 2.40 kHz	012 = .150 kHz	045 = 2.60 kHz	013 = .163 kHz	046 = 2.80 kHz	014 = .175 kHz	047 = 3.00 kHz	015 = .188 kHz	048 = 3.20 kHz	016 = .200 kHz	049 = 3.60 kHz	017 = .225 kHz	050 = 4.00 kHz	018 = .250 kHz	051 = 4.40 kHz	019 = .275 kHz	052 = 4.80 kHz	020 = .300 kHz	053 = 5.20 kHz	021 = .325 kHz	054 = 5.60 kHz	022 = .350 kHz	055 = 6.00 kHz	023 = .375 kHz	056 = 6.40 kHz	024 = .400 kHz	057 = 7.20 kHz	025 = .450 kHz	058 = 8.00 kHz	026 = .500 kHz		027 = .550 kHz		028 = .600 kHz		029 = .650 kHz		030 = .700 kHz		031 = .750 kHz		032 = .800 kHz		033 = .900 kHz	
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BWN?	BWN nrl	<p>Request active IF bandwidth number.</p> <p>Reset: BWN 055</p> <p>Default: BWN 055</p> <p>Example: BWN 028</p>																																																																		

**Table 4-1. Receiver Device Messages (Continued)**

Command	Response	Description
BWS nrf	BWS nr1	Select an IF bandwidth. Range: 1-5 Where: 1 - 0.30 kHz 2 - 1.00 kHz 3 - 3.20 kHz 4 - 6.00 kHz 5 - 8.0 kHz
BWS?	BWS nr1	Request the active IF bandwidth slot. Reset: BWS 4 Default: BWS 4 Example: BWS 1
CHA nrf		Select start channel for channel scan. Range: 00 to 98
CHA?	CHA nr1	Request currently selected channel for channel scan. Example: CHA 25 Default: CHA 0
CHB nrf		Select stop channel for channel scan. Range: 01 to 99
CHB?	CHB nr1	Request currently selected stop channel for channel scan. Example: CHB 26 Default: CHB 99
CHI nrf		Include channel when in channel scan. Range: 0 to 99
CHS nrf		Skip channel when in channel scan. Range: 0 to 99
CLM		Clear all memories.
CTL nrf		Set the device control mode. Range: 0 - 2 Where: 0 - Local 1 - Remote 2 - Remote w/Local Lockout
CTL?	CTL nr1	Request the device control mode. Default: CTL 0 Example: CTL 1



**Table 4-1. Receiver Device Messages (Continued)**

Command	Response	Description
DET nrf		Set the detection mode. Range: 1 - 6 Where: 1 - AM 2 - FM 3 - CW 4 - USB 5 - LSB 6 - ISB 7 - SAM
DET?	DET nr1	Request the active detection mode. Reset: DET 1 Default: DET 1 Example: DET 4
ENA		Continue suspended scan command.
EXE nrf		Recall and execute specified memory channel. Range: 0 to 99
FRA nrf		Select start frequency for Frequency-to-Frequency (F1-to-F2) scan in MHz.
FRA?	FRA nr2	Range: 0.000000 to 29.999999 Request current Frequency-to-Frequency (F1-to-F2) scan start frequency in MHz. Example: FRA 23.123456 Default: FRA 00.000000
FRB nrf		Select stop frequency for Frequency-to-Frequency (F1-to-F2) scan in MHz. Range: 0.000001 to 30.000000
FRB?	FRB nr2	Request current Frequency-to-Frequency (F1-to-F2) scan stop frequency in MHz. Example: FRB 27.123456 Default: FRB 30.000000

**Table 4-1. Receiver Device Messages (Continued)**

Command	Response	Description									
FRQ nrf		Set the tuned frequency in MHz (1-Hz steps).  Range: 00.000000 to 30.000000									
FRQ?	FRQ nr1	Request the tuned frequency. Reset: FRQ 20.000000 Default: FRQ 20.000000 Example: FRQ 12.345678									
INC nrf		Select Frequency-to-Frequency (F1-to-F2) scan increment in kHz.  Range: 0.001 to 25.000									
INC?	INC nr2	Request current Frequency-to-Frequency (F1-to-F2) scan increment in kHz.  Example: INC 20.000 Default: INC 25.000									
LCK nrf nrf		Enter a lockout to be used in the (F1-to-F2) scan w/Lock mode. The lockout is specified as a center frequency only. The lockout width is $\pm$ half of the current IF bandwidth selection. Once stored, the lockout width remains the same, regardless of future IF bandwidth changes. The channel number assigned with this command remains constant as channels are added or deleted. This lockout data overwrites any data previously stored in the selected lockout channel.									
		<table border="1"> <thead> <tr> <th><u>Field</u></th> <th><u>Parameter</u></th> <th><u>Range</u></th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Channel number</td> <td>0 to 99</td> </tr> <tr> <td>2</td> <td>Lockout center frequency</td> <td>0.000000 to 30.000000</td> </tr> </tbody> </table>	<u>Field</u>	<u>Parameter</u>	<u>Range</u>	1	Channel number	0 to 99	2	Lockout center frequency	0.000000 to 30.000000
<u>Field</u>	<u>Parameter</u>	<u>Range</u>									
1	Channel number	0 to 99									
2	Lockout center frequency	0.000000 to 30.000000									
MUT?	MUT nr1	Request the current mute status.  Range: 0,1 Where: 0 = Audio not muted 1 = Audio muted									

**Table 4-1. Receiver Device Messages (Continued)**

Command	Response	Description
NFM nrf		<p>Set the tunable notch filter mode.</p> <p>Range: 0,1 Where: 0 = OFF 1 = Relative (ON)</p> <p>Request the current tunable notch filter mode.</p> <p>Range: 0 to 4 Where: 0 = OFF 1 = Relative (ON) 2 = Not Used 4 = Disabled</p> <p>Note: A disabled response occurs when the notch filter relative setting is outside the specified limits of the selected bandwidth. Refer to <b>paragraph 3.5.10</b>.</p>
NRF nrf		<p>Set the tunable notch filter setting. Refer to <b>paragraph 3.5.10</b> for a list of the maximum relative settings for each bandwidth.</p> <p>Range: -9999 to +9999 Hz</p>
NRF?	NFR nr1	<p>Request the current tunable notch filter setting.</p> <p>Reset: 0000 Default: 0000 Example: -6200</p>

**Table 4-1. Receiver Device Messages (Continued)**

Command	Response	Description																																	
OPR nrf		Select operation mode. Range: 0, 1 Where:           0 = Manual 1 = scan (type of scan is dependent on current scan type (SCF) selection.)																																	
OPR?	OPR nr1	Request current operation mode. Example: OPR 1 Default: OPR 0 Reset: OPR 0 Default: OPR 0																																	
PBT nrf		Selected passband tuning offset frequency. Only effective in CW detection mode. Range: -2000 to +2000 Hz (10 Hz steps)																																	
PBT?	PBT nr1	Request current passband tuning offset frequency in Hz. Example: PBT 1250 Reset: PBT 0 Default: PBT 0																																	
RCL? nrf	RCL nr1,nr1, nr2,nr1,nr1,nr1, nr1,nr1	Recall selected memory channel parameters. Range: 0 to 99																																	
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10	Remote Manual Gain Level (RFG)	000 - 127																																	

**Table 4-1. Receiver Device Messages (Continued)**

Command	Response	Description
REF?	REF nr1	Request the status of the external reference. Range: 0 - 4 Where: 0 - Internal 1 - 10 MHz External 2 - 5 MHz External 3 - 2 MHz External 4 - 1 MHz External Example: REF 3
RFG nrf		Set the remote manual gain level. Range: 000 -127
RFG?	RFG nr1	Request the remote manual gain level. Reset: RFG 000 Default: RFG 000 Example: RFG 123
RFP nrf		Select the RF input path. Range: 1 - 3 Where: 1 - Normal 2 - Attenuated 3 - Preamplified
RFP?	RFP nr1	Request the selected RF input path. Reset: RFP 1 Default: RFP 1 Example: RFP 2
RLK? nrf	RLK nr1,nr2	Recall the selected lockout channel center frequency. When the lockout memory channel is vacant a frequency of 31.000000 MHz is returned. Range: 0 to 99 Example: 12, 27.123456
SCF nrf		Select desired scan type. Range: 1 to 3 Where: 1 = Channel scan 2 = F1-to-F2 3 = F1-to-F2 w/Lock
SCF?	SCF nr1	Request the currently selected scan type. Example: SCF 1 Default: SCF 2

**Table 4-1. Receiver Device Messages (Continued)**

Command	Response	Description
SCS?	SCS nr1	Request the current receiver scan status. Range: 0 to 3 Where: 0 = No scan 1 = Scan 2 = Scan dwell 3 = Scan paused
SDW nrf		Select the scan dwell time. Range: 0.5 to 20 seconds, 0 = infinite
SDW?	SDW nr1	Request currently selected scan dwell time. Example: SDW 2 Default: SDW 0.5
SGV?	SGV nr1,nr1	Request the signal strength value (in dBm) and squelch status value. Range: +20 to -135,0-1 Where: nr1,0 - squelch on nr1,1 - squelch off Reset: No Change Example: SGV -123,0
SLM?	SLM nr1	Request number of unused lockout channels available. Range: 0 to 100 Example: SLM 75 Reset: SLM 100
SPK nrf		Select speaker type. Range: 1 to 3 Where: 1 = USB 2 = Both 3 = LSB
SPK?	SPK nr1	Request currently selected speaker type. Example: SPK 2 Default: SPK 2

**Table 4-1. Receiver Device Messages (Continued)**

Command	Response	Description																																				
SQL nrf		Set squelch level in negative dBm. Range: 0 to 135, 136 = squelch off																																				
SQL?	SQL nr1	Request the squelch level setting in -dBm (136 = squelch off). Example: SQL 90 Reset: SQL 136																																				
STO nrf	OPR nr1	Store front panel parameters to selected memory channel. Range: 0 to 99																																				
STS?		Request current receiver parameters. Example: FRQ12.34567, AGC2, RFG123, BFO-1234, BLK10, BWS5, DET1, SLQ123, SPK1, RFP2, PBT1250																																				
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SUS		Suspend scan command. Suspends scan in the same manner as the front panel "pause" key pauses scan. Scan may be continued using the ENA command.																																				
ULK nrf		Unlock selected lockout memory channel. Range: 0 to 99																																				

4.5 **COMMUNICATION MESSAGES**

Communication messages are always valid. These are commands which establish communications between the HF-1000 and the controller. All HF-1000 communication messages are listed in **Table 4-2**. Common communication messages are prefixed with an asterisk.

**Table 4-2. Communication Messages**

Command	Response	Description
CDE?	CDE nr1	Request the current Device-Dependent Error Register value. Example: CDE 00255 Range: 00000 - 65535 See <b>Table 4-6</b> for bit-mapped detail.
*CLS		Clears all communication status registers.
*ESE nrf		Set the Event Summary Enable Register. See discussion of the Event Summary Registers for bit-mapped details. Range: 0 - 255
*ESE?	*ESE nr1	Request the Event Summary Enable Register value. Reset: No change Default: *ESE 000 Example: *ESE 128
*ESR?	*ESR nr1	Request the Event Summary Status Register value. See Table 4-4 for bit-mapped details. Example: *ESR 016 Range: 0 - 255  Bit 0 - OPC Operation Complete Bit 1 - Not Used Bit 2 - QYE Query Error Bit 3 - DDE Device-Dependent Error Bit 4 - EXE Execution Error Bit 5 - CME Command Error Bit 6 - Not Used Bit 7 - PON Power On
*IDN?	*IDN (see example)	Request receiver identity. The fields provide information in the following order: model number, space reserved for future expansion, and software version number. Example: *IDN HF1000,0,1.40
LDE?	LDE nr1	Request the latched Device-Dependent Error Register value. Example: LDE 00255 Range: 00000 - 65535 See <b>Table 4-6</b> for bit-mapped detail.



**Table 4-2. Communication Messages (Continued)**

Command	Response	Description																														
*LRN?	*LRN nr2,nr1, nr1,nr1,nr1,nr1, nr1,nr1,	Request current HF-1000 operating parameters. The data returned for this query is field dependent.																														
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*OPC		Operation complete switch. When this command is sent with a data string, the OPC bit in the Event Summary Status Register will be set upon completion of the operation(s) in the input buffer. An SRQ may be generated with corresponding bit enabled.																														
*OPC?	*OPC 1	An *OPC 1 string will be loaded into the output buffer (returned at the completion of the operation in the input buffer).																														
*OPT?	*OPT nr1,nr1	Request the options currently installed in the receiver. The returned response is a bit-mapped value of two 8 bit bytes. Range: 0 - 255, 0 - 255 Example: *OPT 016  1st nr1 bit-mapped response: Bit 0 - Preselector Option Bit 1 - Extended Bandwidths Bit 2 - Tuned Carrier Bit 3 - Variable Line Audio Bit 4 - Tunable Notch Filter Bit 5 - AGC/Detection Mode Matching Bit 6 - Zero Digit tuning Bit 7 - Synchronous AM  2nd nr1 bit-mapped response: Bit 0 - AGC Enhancements Bit 1 to Bit 7 Reserved for future expansion																														

**Table 4-2. Communication Messages (Continued)**

Command	Response	Description
*RSE nrf		<p>This command allows writing to a register that enables interrupts to be passed from the RSR register to the *STB register via its RSB bit.</p> <p>BIT           FUNCTION</p> <p>0            Enable PRS, signal exceeded COR event to set the RSB bit.</p> <p>1-3          Not Used</p> <p>4            Enable ESN, end of single scan event to set the RSB bit.</p> <p>5-7          Not used.</p>
*RSE?	*RSE nr1	<p>Request the contents of the Receiver Status Enable Register.</p> <p>Reset: no change Default: *RSE 000 Example: *RSE 016</p>
*RSR?	*RSR nr1	<p>Read the Receiver Status Register. The information included in this register is latched. It is cleared by the *CLS command or a read of the register. The information in the register discloses the reason for the RSB bit to be set in the Status Byte Register.</p> <p>BIT           FUNCTION</p> <p>0            PRS, signal exceeded COR threshold. This is an edge triggered event on the action of a signal going from below COR threshold to above COR threshold.</p> <p>1-3          Not used.</p> <p>4            ESN, end of single scan. This bit indicates the end of scan has been encountered. This bit is only set while in a scan mode. (F1→F2, F1→F2 w/Lock, Channel)</p> <p>5-7          Not used</p>
*RST		For all device parameters to their reset condition.

**Table 4-2. Communication Messages (Continued)**

Command	Response	Description
*SRE nrf		Set the Service Request Enable Register. See discussion of the Status Byte Registers for bit-mapped details. Range: 0 - 255
*SRE?	*SRE nr1	Request the Service Request Enable Register value. Reset: No Change Default: *SRE 000 Example: *SRE 032
*STB?	*STB nr1	Request the Status Byte Register value. See Table 4-3 for bit-mapped details. Range: 0 - 255 Example: *STB 064  Bit 0 - RSB Bit 1 - Not Used Bit 2 - Not Used Bit 3 - Not Used Bit 4 - Not Used Bit 5 - ESB Event Summary Bit Bit 6 - RQS Request Service Bit 7 - Not Used
*TST?	*TST nr1	Execute built-in-test (BITE) and report outcome. The response is a bit-mapped value of 16 bits, representing the success or failure of each test. Any failed test will set the associated bit as listed below. Range: 0 - 65535 Example: *TST 00000  Bit Failure 0 Control to DSP transmit pipeline not empty. 1 Control to DSP download unsuccessful. 2 DSP EPROM download unsuccessful. 3 Control command no acknowledged. 4 No DSP response to control request. 5 DSP memory check did not complete. 6 DSP EPROM failure. 7 DSP SRAM failure. 8 RF test failed. 9 Control A/D failure. 10 Non-SSB audio failure. 11 USB audio failure. 12 USB audio in LSB path failure. 13 LSB audio failure. 14 LSB audio in USB path failure. 15 DSP A/D failure.

#### 4.6 RECEIVER STATUS SUMMARY

**Figure 4-1** illustrates the architecture of the receiver's status registers. It is composed of six eight-bit registers and one 16-bit register, whose logic gating allows the programmer great flexibility in remote operations. The eight bit registers can be split into three pairs. Each pair consists of a status register and an enable register.

One pair is composed of the Event Summary Status Register (whose functions are summarized in **paragraph 4.6.2**) and the Event Summary Status Enable Register. Each bit in the Event Summary Status Register is logically ANDed to a bit in the Event Summary Status Enable Register. The ANDed combination of these two registers are logically ORed to set the Event Summary Status Bit (ESB) of the Status Byte Register. The Device-Dependent Error Bit (DDE) of the Event Summary Status Register is the ORed combination of the 16-bit Device-Dependent Error Register (see **paragraph 4.6.4**).

The second pair is composed of the Status Byte Register and the Service Request Enable Register. The receiver uses only three bits of the Status Byte Register as described in **Table 4-3**. The ANDed combination of bits 0 and 5 of the Status Byte Register and the Service Request Enable Register are logically ORed to determine the setting of bit six (RQS) of the Status Byte Register. If the RQS bit is set high, a service request is asserted.

**Table 4-3. Status Byte Register, Bit Evaluation**

Bit Number	Mnemonic	Description
0	RSB	<b>Receiver Status Bit</b> - This bit, when set, indicates that an event has caused a bit or bits in the Receiver Status Register to be set (see <b>paragraph 4.6.3</b> ). This bit is cleared by *CLS or by reading the contents of the Receiver Status Register using the RSR? query.
1-4	Not Used	
5	ESB	<b>Event Summary Bit</b> - This bit, when set, indicates that the Event Summary Status Register has set SRQ. By reading the Event Summary Status Register via the *ESR? mnemonic, the host controller may identify what status event has caused the SRQ. This bit is cleared by sending, *CLS or reading the contents of the Event Status Register.
6	RQS	<b>Request Service Bit</b> - This bit, when set, indicates that the unit has asserted SRQ.
7	Not Used	

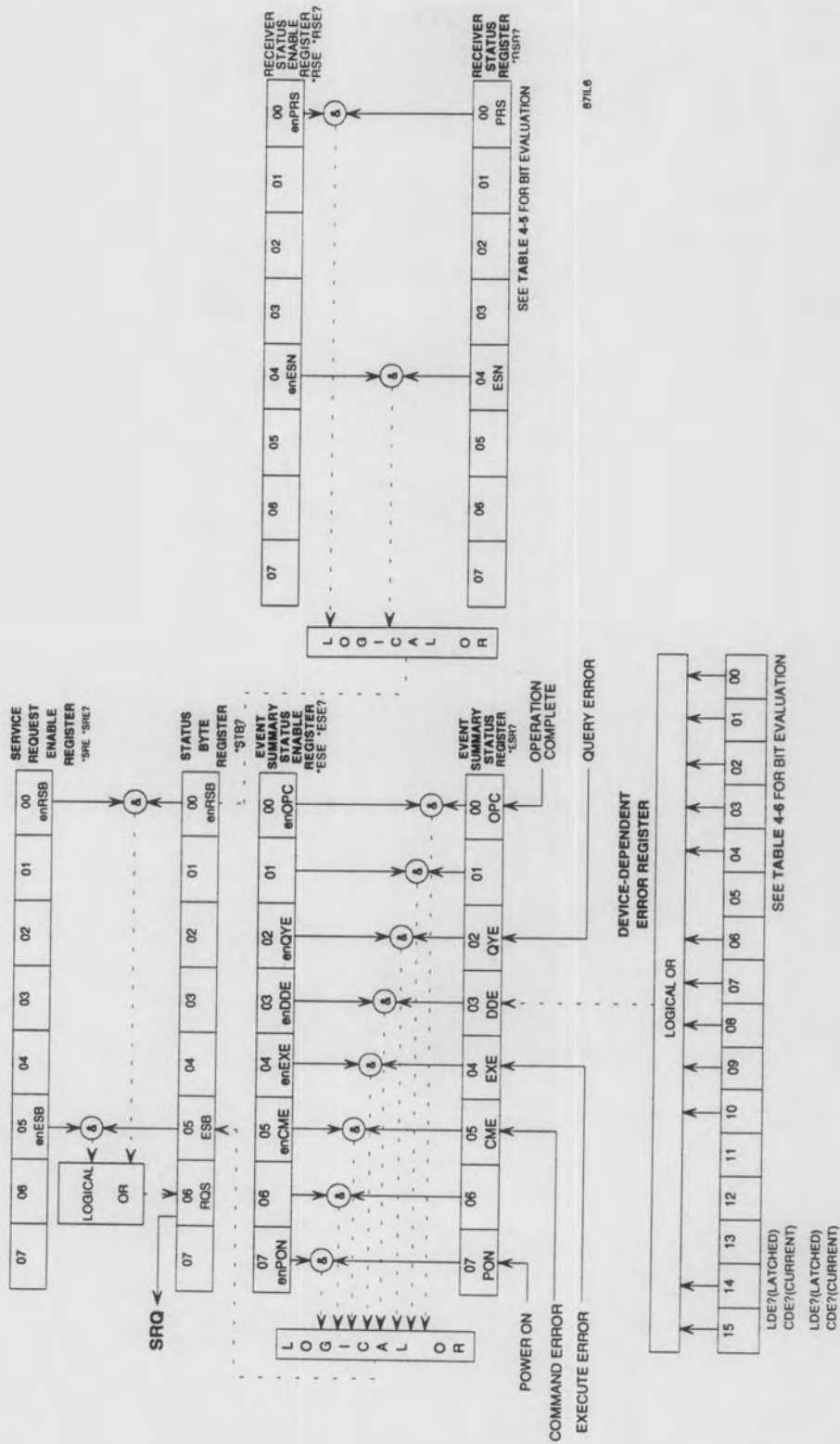


Figure 4-1. Receiver Status Data Structure

NOTES

#### 4.6.1 STATUS BYTES

The following information discusses the operation of the SRQ interrupt and the "\*STB?" query. The operation of these is very similar. The SRQ interrupt allows the controller to establish which event has caused the receiver to set the SRQ. The "\*STB?" query response includes similar information as detailed below.

**SRQ** - This is a one byte control character (ESC) indicating a service request. When SRQ is generated, it is immediately followed by the output of the Status Byte Register if enabled. This clears the SRQ and the Status Byte Register. The evaluation of each bit in this status byte is in **Table 4-3**.

**\*STB? Query** - The Status Byte Register can also be read using the \*STB? query. Sending \*STB? does not clear the SRQ status line or the Status Byte Register.

The Service Request Enable Register allows status bits to generate service requests. Setting a status bit will set service request if and only if the corresponding enable bit is set. Service Request Enable Register bit six is ignored and reported as zero. This bit would correspond to the RQS bit of the Status Byte Register which triggers service request.

#### 4.6.2 EVENT SUMMARY STATUS REGISTER

The following discussion covers the Event Summary Status Register and the \*ESR? query. See **Table 4-4** for the Event Summary Status Register bit numbers, mnemonics and descriptions.

The Event Summary Status Register is read destructively by the \*ESR? query, which clears the register. The \*CLS command also clears the register. The power on sequence automatically sets the Power On bit and initially resets the remaining bits.

The Event Summary Status Enable Register allows the event flags of the Event Summary Status Register to be reflected in the Event Summary Bit (ESB) of the Status Byte. The setting of an event status flag sets ESB high only if the corresponding bit in the Event Summary Status Enable Register is set high. The Event Summary Status Enable Register is written to with the \*ESE command. The data following the mnemonic is the decimal equivalent of a binary number representing the register bits. The \*ESE? query loads the output buffer with a decimal number, which can be converted to binary to determine the setting of the Event Summary Status Enable Register.

**Table 4-4. Event Summary Status Register, Bit Evaluation**

Bit Number	Mnemonic	Description
0	OPC	<b>Operation Complete</b> - This bit is set on completion of operation that has been designated by the *OPC command.
2	QYE	<b>Query Error</b> - Set on an attempt to read data from the output buffer with no data stored or pending, or the output buffer is dumped for any cause except device clear, such as an overflow.
3	DDE	<b>Device-Dependent Error</b> - Set when a hardware error occurs within the receiver.
4	EXE	<b>Execution Error</b> - Set when an out of range data element follows a known message header or when a valid message count not be executed due to some device condition.
5	CME	<b>Command Error</b> - Set when an unrecognized message header has been received.
7	PON	<b>Power On</b> - Set during the power-up sequence. Also set when a Device or Select Device Clear is received.

#### 4.6.3 RECEIVER STATUS REGISTER

The Receiver Status Register allows for interrupts to be generated when particular operational events occur. The information in this register discloses the reason for the RSB bit to be set in the Status Byte Register. The \*RSR? query reads the latched contents of this register and clears it. It is also cleared by \*CLS. See **Table 4-5** for the bit evaluation of the Receiver Status Register.



**Table 4-5. Receiver Status Register, Bit Evaluation**

Bit	Decimal Value	Function
0	1	PRS, signal exceeded COR threshold. This is an edge triggered event on the action of a signal going from below COR threshold to above COR threshold.
1	2	Not used
2	4	Not used
3	8	Not used
4	16	ESN, end of scan. This bit indicates the end of scan has been encountered. This bit is only set while in a scan mode (F1→F2, F1→F2 w/Lock, or Channel).
5	32	Not used
6	64	Not used
7	128	Not used

## 4.6.4

**DEVICE-DEPENDENT ERROR REGISTER**

The contents of the Device-Dependent Error Register can be read to determine what event has caused the DDE bit in the Event Status Register to be set. The CDE? and LDE? queries are used as further discussed below.

The LDE? query request the latched error status. The response is a bit-mapped 16-bit word indicating the error conditions that have occurred since the last read of the register. Reading the contents of the register also clears it. See **Table 4-6** for a bit evaluation of the Device-Dependent Error Register.

The CDE? query request the current device error. The response to this query is also a bit-mapped 16-bit word as detailed in **Table 4-6**. Reading this register has no effect on it.

**Table 4-6. Device-Dependent Error Register, Bit Evaluation**

Bit	Decimal Value	Mnemonic	Description
0	1	DSP ERR 1	Control to DSP transmit pipeline not empty.
1	2	DSP ERR 2	Control to DSP download unsuccessful.
2	4	DSP ERR 3	DSP EPROM download unsuccessful.
3	8	DSP ERR 4	Control command not acknowledged by DSP.
4	16	DSP ERR 5	No DSP response to Control request.
5	32	Not Used	
6	64	PS ERR 1	-12 Volt Supply Low.
7	128	PS ERR 2	+12 Volt Supply Low.
8	256	BATT ERR	Battery Voltage Low.
9	512	LO ERR	Local Oscillator Unlocked.
10	1024	REF ERR	Unknown External Reference.
11	2048	RAM FAIL	Control Processor RAM Failure.
12	4096	CHKSUM	EPROM Checksum Error.
13	8192	PRESEL OVRLD	Preselector Overload (when the HF-1000/PRE option is installed).
14	16384	Not used	
15	32768	Not used	

## 4.7

**MESSAGE PROCESSING**

When the HF-1000 receives a remote message, it stores it in an input buffer circuit until it receives a valid message terminator (LF). When the terminator is received, the message is parsed and executed.

The format of the received message is checked for validity as the message is parsed and executed. If the message fails to meet the restrictions of the command message format, it is ignored.

#### 4.8 RS-232 COMMUNICATIONS PROTOCOL

The communications protocol for the HF-1000 implements both ENQ/ACK (ENquire/ACKnowledge) and XON/XOFF (ctl Q/ctl S) software handshakes. The ENQ/ACK format, typically referred to as "transmitter protocol", allows the operator to send an "ENQ" character to the HF-1000 when an acknowledge is required. The receiver then responds with the ACK/NAK (ACKnowledge/Not AcKnowledge) character indicating the validity of the data received in the input buffer and the fact the unit has completed all current data through to the last received terminator. The XON/XOFF format supports both transmit and receive communications. This format, typically referred to as "receiver protocol", allows transmission based on the availability of buffer space (refer to **paragraph 4.8.3**).

**Table 4-7** lists the supported communications control commands for RS-232 remote operation. The following paragraphs provide more details on the ENQ/ACK and XON/XOFF protocol, and buffer control.

**Table 4-7. Supported RS-232C Communications Control Commands**

HEX	ASCII	Receive	Transmit	Function
11	DC	x	x	XON, allow data transmission
13	DC3	x	x	XOFF, disallow data transmission
05	ENQ	x		Enquire, request acknowledge
06	ACK		x	Acknowledged, data received
15	NAK		x	Not acknowledged, data communications error
0A	LF	x	x	Line feed, start processing input buffer
0D	CR	x	x	Carriage return, no action

##### 4.8.1 XON/XOFF PROTOCOL

The XON/XOFF communications protocol is always active in the HF-1000. In the event the buffer has room for less than 16 additional characters the unit will output an XOFF character. When the unit empties its input buffer, it issues an XON character. The user must stop sending data within 15 characters after receiving the XOFF character. On each character that is received while the buffer is full, the unit issues an XOFF character. The user may start sending data to the unit after receiving the XON character.

The HF-1000 responds to the XON and XOFF commands while outputting data to the user. If the unit receives an XOFF while sending, it stops transmitting within two characters. The unit will not transmit any further data until an XON is received. The HF-1000 assumes the XON condition at power-up.

#### 4.8.2 ENQ/ACK PROTOCOL

When the ENQ character is sent to the HF-1000, it responds to a valid message with an ACK, or to an invalid message with a NAK. An invalid message is indicated on a data communications error such as framing, noise, or overrun. The transmission of a NAK indicates that one or more of the bytes received after the last ENQ has a communications error. The ACK/NAK response is only sent after the unit has completed processing any previous messages in the input buffer and has output any response necessary. See **Table 4-7**.

HF-1000 internally maintains a communications error flag. The flag is cleared on power-up or the transmission of a NAK. The flag is set when a byte is received with a data communications error. Upon receiving an ENQ character, the unit responds with an ACK/NAK based on the condition of the communications flag, after any pending input and output operations are complete.

#### 4.8.3 BUFFER HANDLING

##### 4.8.3.1 Input Buffer

The input buffer is handled in circular fashion allowing simultaneous inputting and processing of data. The input buffer accepts up to 1024 bytes before overflowing. As data in the buffer is being processed, additional inputs can be accepted by the unit. Upon receiving a terminator character, the HF-1000 processes any previous messages in the buffer. When the buffer has less than 16 unused bytes, XOFF is generated. XON is generated when the buffer has less than 16 bytes remaining to be processed.

The input buffer processing starts on the receipt of a terminator (LF). If the communications error flag is set, the buffer contents from the end of the last processed message thru the message terminator is discarded. In the event the buffer is overrun, its contents are discarded. Messages such as XON, XOFF, and ENQ have immediate actions. These commands are processed on receipt and are not buffered. All other incoming data is buffered and processed in the order in which it was received.

##### 4.8.3.2 Output Buffer

The output buffer is handled in circular fashion allowing simultaneous additions and outputting. The transmission of XON/XOFF has priority over data in the output buffer that is awaiting transmission. The ACK/NAK transmission are buffered operations so they stay in time synchronization with query operations. The output buffer holds up to 1024 bytes of data.

**SECTION V**  
**CSMA REMOTE CONTROL**

## SECTION V

### CSMA REMOTE CONTROL

#### 5.1 INTRODUCTION

This section provides information for remotely controlling the HF-1000 Digital HF Receiver on a CSMA/CD type of interface. CSMA/CD, or Carrier Sense/Multiple Access with Collision Detection (hereafter referred to as simply CSMA), is a media access method that allows two or more stations (up to 63) to share a common bus medium. To transmit, a station waits (defers) for a quiet period on the medium (that is, no other station is transmitting) and then sends the intended message in bit-serial form. If, after initiating a transmission, the message collides with that of another station, then each transmitting station intentionally sends a few additional bytes to ensure propagation of the collision throughout the system. The station remains silent for a random amount of time (backoff) before attempting to transmit again.

The HF-1000 can be set for CSMA remote control by selecting "CSMA" in the remote control entry mode with the SPECIAL FUNCTION key. The baud rate and CSMA address can also be set in entry modes selected with this key. Refer to **paragraph 3.11** details on configuring the receiver for remote operation.. Switch 4 of DIP switch A2S1 can be set to the on (down) position to activate the CSMA remote control. Baud rate hardware default can also be selected. The CSMA address hardware default can be selected with switch A2S2. The tuned frequency format can be set to four bytes or five bytes with A2S2. Refer to **paragraph 2.2.5** for details on configuring DIP switches A2S1 and A2S2.

The following receiver parameters are controllable via the CSMA interface:

- local control, remote control, or remote control with local lockout,
- tuned frequency,
- BFO frequency,
- detection mode,
- IF bandwidth,
- gain mode,
- manual gain, and
- RF input path.

This section of the manual contains information necessary to enable an operator to control and monitor the above receiver parameters from an external controller on the CSMA interface. Details on how to properly format and transmit remote messages and how to read responses from the receiver are provided.

Before attempting to operate the receiver remotely, it is recommended that the operator become familiar with the operation and capabilities of the receiver by viewing the information provided in **Section III** of this manual. It is also recommended that the operator become familiar with the operation of the controller by viewing its literature.

5.2 **ELECTRICAL REQUIREMENTS OF THE INTERFACE**

Figure 5-1 shows the circuitry of the CSMA interface in the HF-1000. The interface is implemented on a mini-phones jack (A2J2) located on the rear panel, labeled CSMA. The sleeve of this connector is connected to chassis to ground. The center conductor carries the bidirectional serial data line. For proper communications on the interface, a logic HIGH input should be +2 volts minimum. A logic LOW input should be +0.7 volts maximum. These logic levels are compatible with standard TTL and 5 volt CMOS logic drivers. With appropriate level shifting circuitry, any computer equipped with an RS-232C interface port can be used to control the HF-1000 via its CSMA interface. To reduce the adverse effects of reflections on the line, resistive terminations are recommended on each end of the interface cable. The DC bias introduced by the terminations must exceed +2.5 volts. A single resistor at each end of the cable, connected between a clean +3 to +5 volt supply and the data line, is usually adequate. Be sure that all devices connected to the CSMA interface have sufficient drive capability to transmit data onto the line. The HF-1000 CSMA port can sink up to 100 mA at a logic low output voltage of +0.7 volts.

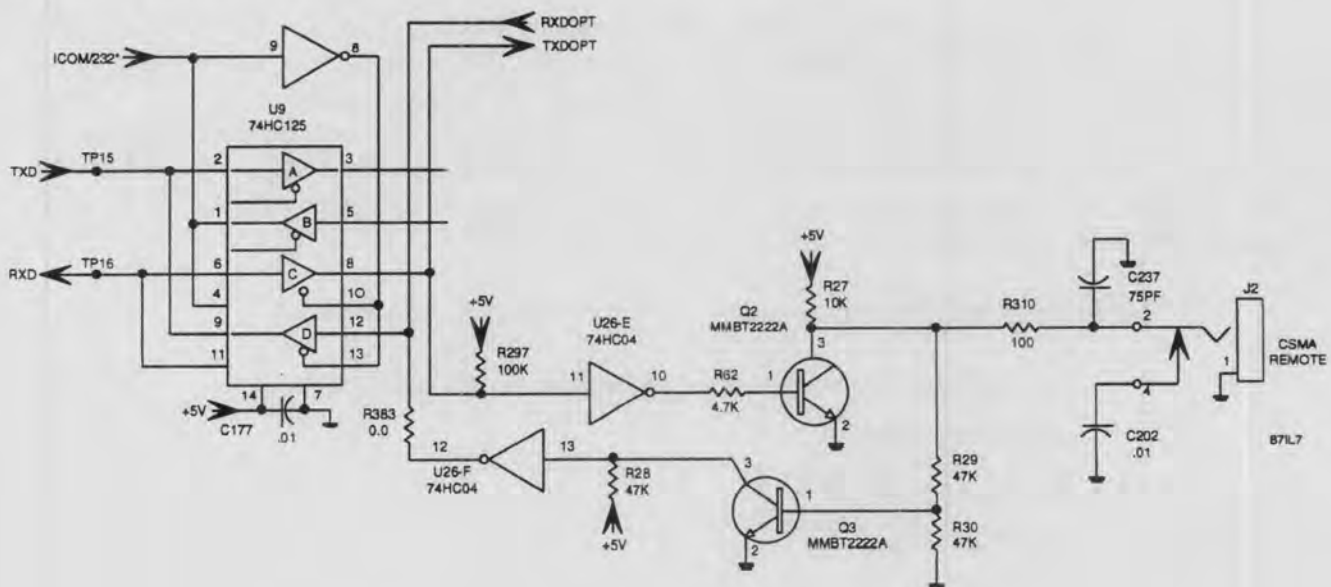
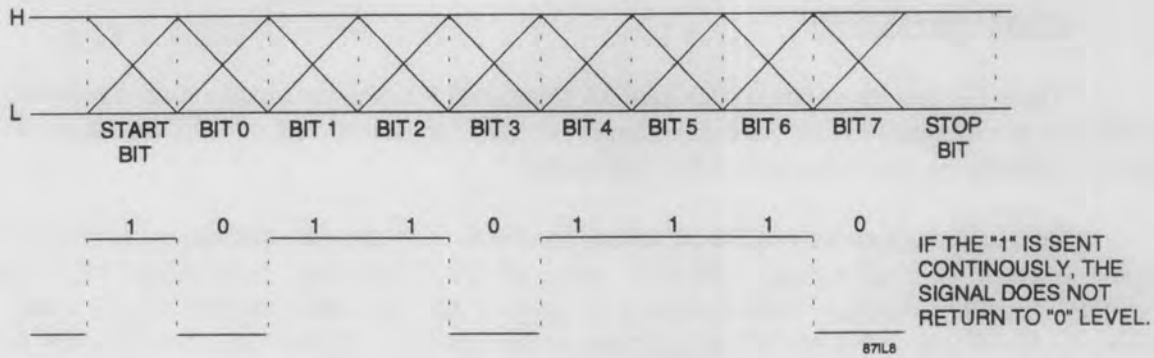


Figure 5-1. CSMA Interface Circuit

5.3 **SERIAL DATA TRANSMISSIONS**

Data in serial transmissions is read from the transition of the change in state (i.e., high to low, or low to high). Data transmitters and data receivers connected on the interface exchange serial information using the NonReturn to Zero (NRZ) format. This means, in baseband transmissions, if a logic "1" is continuously sent the signal does not return to logic "0" until a logic "0" is sent. The composition of one byte of data is shown in Figure 5-2 with an example of the NRZ format.

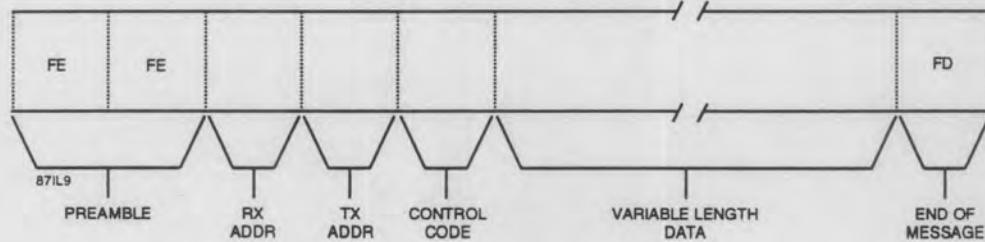


**Figure 5-2. Composition of One byte of Serial Data**

5.4

**COMMAND MESSAGE FORMATTING**

The typical command message format used with this interface is provided in **Figure 5-3**. Each block in the packet contains one byte of data. As shown in the figure the packet consists of two preamble bytes, a receiving station address byte, a transmitting station address byte, a control code byte, variable length data bytes, and an end of message byte. All information contained in bytes is expressed in hexadecimal except for variable length data bytes which are expressed in packed binary coded decimal (BCD).



**Figure 5-3. Typical Command Message Format**

The preamble [FE|FE] identifies the start of a message. The receiving station address (RX ADDR) identifies the address of the unit that is to receive the data. The HF-1000's address setting should be entered at this location. The transmitting station address identifies the address of the controller sending the data. The control code represents the HF-1000 function that is to be controlled. This code should always be sent in hexadecimal format. The variable length data field contains data that accompanies the control code to set certain values of the function. This data field can contain any number of bytes required to send the data. Data in these bytes should always be sent in binary coded decimal format. The end of message byte [FD] identifies the end of the message being transmitted.



5.5 **CONTROL CODES**

**Table 5-1** lists the control codes used for controlling the receiver functions. The control codes listed are shown in hexadecimal format. A description is provided for each control code. Data accompanying control codes is shown in packed binary coded decimal format.

Certain control codes require an acknowledgment from the host controller that their format was valid and accepted. For all control codes that require an acknowledgment, hexadecimal FB (ACK) is returned to the controller when the control code is recognized and the accompanying data is within the specified range. Hexadecimal FA (NAK) is returned to the controller if either the control code sent is unsupported or if the accompanying data sent with a supported control code is out of range. Note that unless otherwise indicated the control code requires an acknowledge.

**Table 5-1. CSMA Control Code**

Control Code (Hexadecimal)	Description (Packed BCD)
00	Set the tuned frequency in Hz without acknowledge. Range: 00000000 - 30000000
01	Set the detection mode (first data byte) and IF bandwidth (second data byte) without acknowledge. Where: 00 - LSB 01 - USB 02 - AM 03 - CW 05 - FM 06 - ISB 07 - SAM  And: 01 - 0.30 kHz 02 - 1.00 kHz 03 - 3.20 kHz 04 - 6.00 kHz 05 - 16.0 kHz
02	Request the tuned frequency range.
03	Request the tuned frequency.
04	Request the selected detection mode and IF bandwidth.
05	Set the tuned frequency in Hz with acknowledge. Range: 00000000 - 30000000

**Table 5-1. CSMA Control Codes (Continued)**

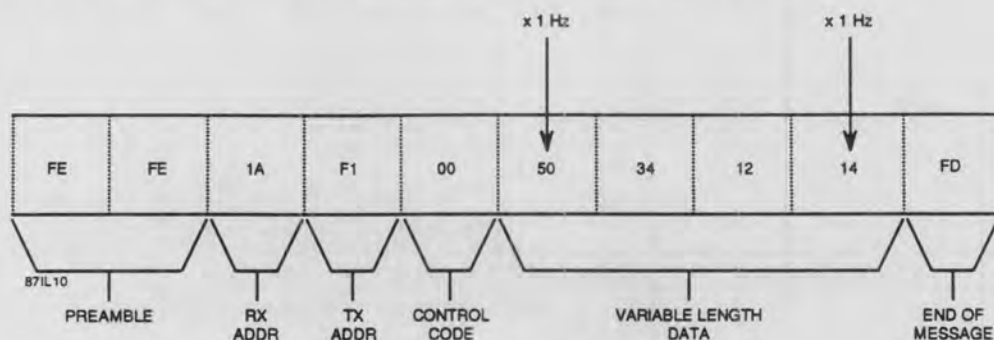
Control Code (Hexadecimal)	Description (Packed BCD)
06	Set the detection mode (first data byte) and IF bandwidth (second data byte) with acknowledge. Where: 00 - LSB 01 - USB 02 - AM 03 - CW 05 - FM 06 - ISB 07 - SAM And: 01 - 0.30 kHz 02 - 1.00 kHz 03 - 3.20 kHz 04 - 6.00 kHz 05 - 16.0 kHz Note: The ISB, LSB, or USB detection modes will force the unit into the 3.20 kHz IF BW.
30	Request active gain control mode.
31	Select gain control mode with acknowledge. Where: 00 - Manual 01 - Slow AGC 02 - Fast AGC 03 - Medium AGC
32	Request the remote manual gain level.
33	Set the remote manual gain level with acknowledge. Range: 0000 - 0127
34	Request current BFO frequency.
35	Set BFO frequency in Hz (in 10 Hz steps) with acknowledge. The third data byte contains the sign in hexadecimal (0E for negative and 0A for positive). Range: -8000 to +7999 Where: +0000 = BFO Off
36	Request the device control mode.
37	Set the device control mode with acknowledge. Range: 00 - 02 Where: 00 - Local 01 - Remote 02 - Remote w/Local Lockout
38	Request the selected RF input path.
39	Select the RF input path with acknowledge. Range: 01 - 03 Where: 01 - Normal 02 - Attenuated 03 - Preamplified

5.6 **DETAILS ON COMMAND AND RESPONSE FORMATS**

The following paragraphs provide examples of command and response formats for each control code listed in **Table 5-1**. In the examples, the receiver's address is assumed to be hexadecimal 1A (decimal 26) and the controller's address is assumed to be hexadecimal F1 (decimal 241). It is also assumed that the tuned frequency format is set to four bytes with A2S2 (**paragraph 2.2.5**).

5.6.1 **TUNED FREQUENCY COMMAND WITHOUT ACKNOWLEDGE [00]**

**Figure 5-4** shows an example of the typical format for setting the receiver's tuned frequency using control code [00]. This control code does not require an acknowledgment.

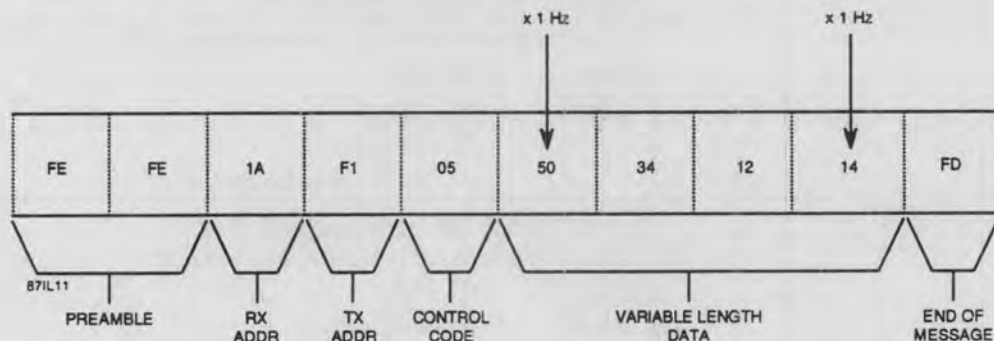


**Figure 5-4. Tuned Frequency Command Format without Acknowledge**

The frequency can be set to any value from 0 to 30.0 MHz at a resolution of 1 Hz. The frequency entered in the example is 14.123450 MHz. The first byte of the frequency data contains Hz data. The last (fourth) byte contains MHz data. If less than four bytes accompany the frequency control code, only those lower resolution value are changed and the higher resolution values (bytes not sent) remain the same.

5.6.2 **TUNED FREQUENCY COMMAND WITH ACKNOWLEDGE [05]**

**Figure 5-5** shows an example of the typical format for setting the receiver's tuned frequency using control code [05]. This control code requires an acknowledgment from the controller.



**Figure 5-5. Tuned Frequency Command Format with Acknowledge**

The frequency can be set to any value from 0 to 30.0 MHz at a resolution of 1 Hz. The frequency entered in the example is 14.123450 MHz. The first byte of the frequency data contains Hz data. The last (fourth) byte contains MHz data. If less than four bytes accompany the frequency control code, only those lower resolution value are changed and the higher resolution values (bytes not sent) remain the same.

5.6.3 **RESPONSE TO TUNED FREQUENCY REQUESTS [03]**

Figure 5-6 shows an example of the typical response format when requesting the tuned frequency with control code [03].

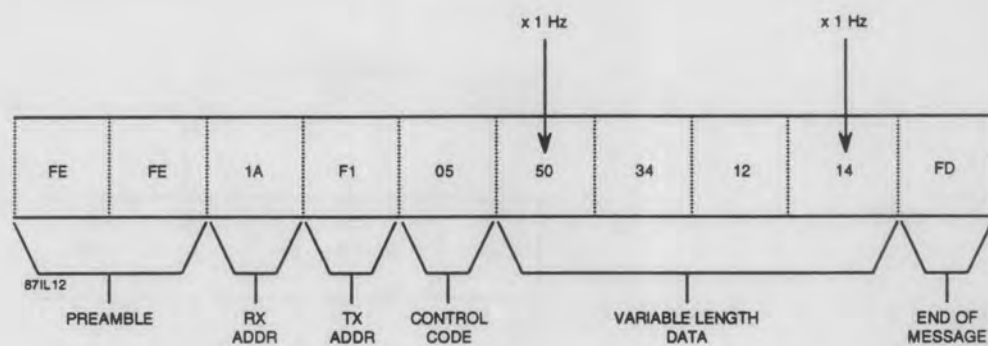


Figure 5-6. Tuned Frequency Request Response Format

The response in the example is 14.123450 MHz. The first byte of the frequency data contains Hz data. The last (fourth) byte contains MHz data. The response always contains all four bytes of the frequency data.

5.6.4 **RESPONSE TO TUNED FREQUENCY RANGE REQUESTS [02]**

Figure 5-7 shows an example of the typical response format when requesting the tuned frequency range of the receiver with control code [02].

In the response the upper frequency limit and the lower frequency limit is separated with 2D hex. The first byte of the frequency data in each limit in the response contains Hz data. The last (fourth) byte contains MHz data. The upper frequency limit response always contains data representing 30.000000 MHz [00100100130]. The lower frequency limit response always contains data representing 0 Hz [00100100100].

5.6.5 **DETECTION MODE/IF BANDWIDTH COMMAND WITHOUT ACKNOWLEDGE [01]**

Figure 5-8 shows an example of the typical format for selecting the receiver's detection mode and IF bandwidth using control code [01]. This control code does not require an acknowledgment.

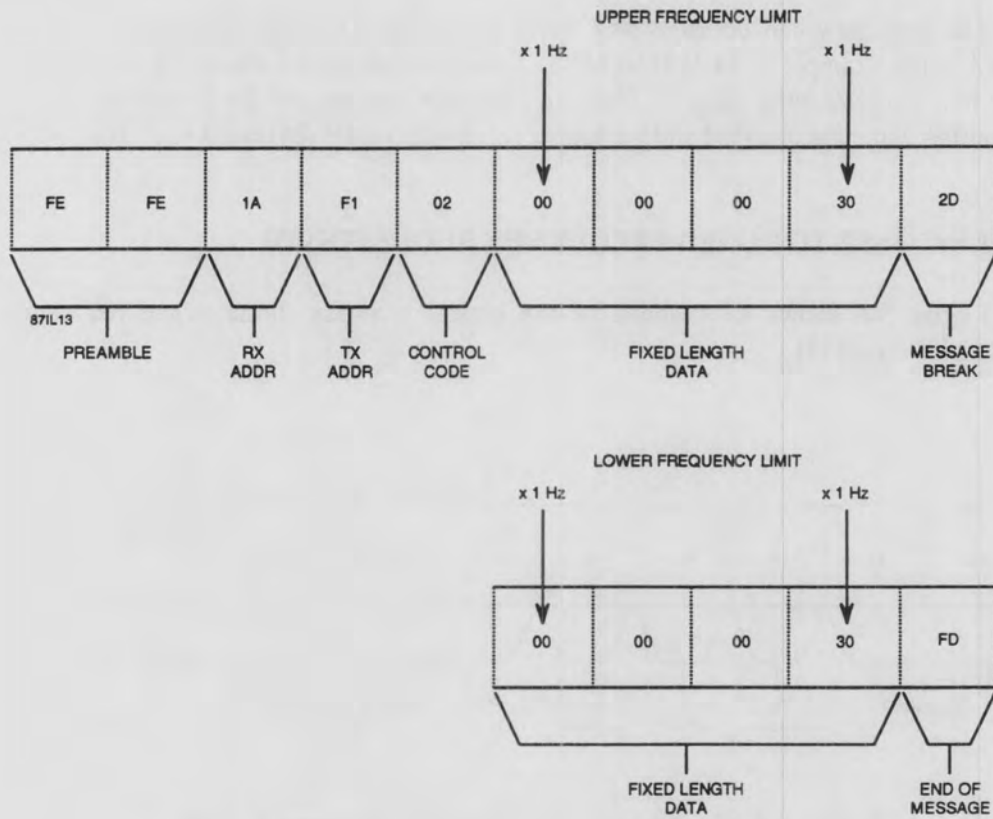


Figure 5-7. Tuned Frequency Range Request Response Format

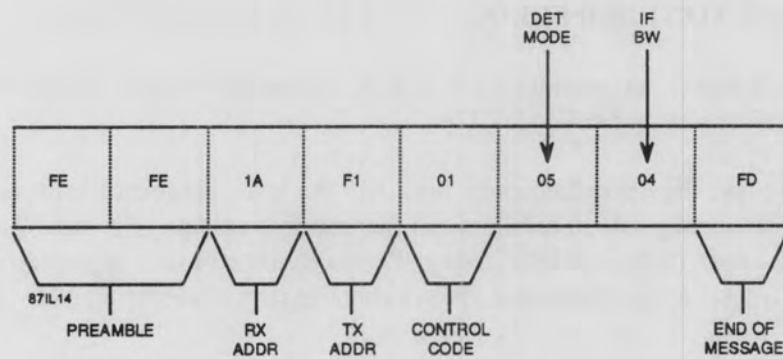
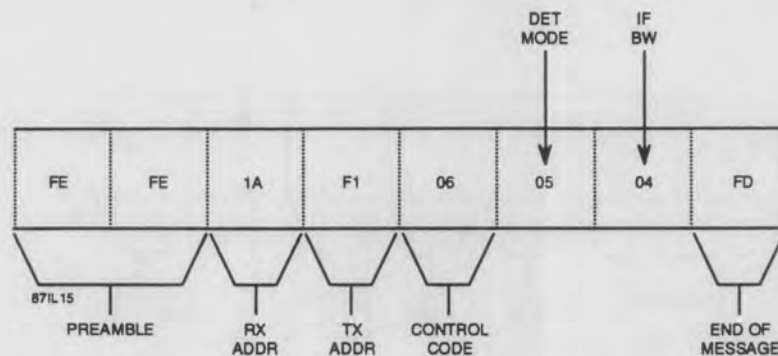


Figure 5-8. Detection Mode/IF Bandwidth Command Format Without Acknowledge

The first byte after the control code contains the detection mode code. The second byte contains the IF bandwidth code. See control code [01] in **Table 5-1** for the detection mode and IF bandwidth choices and their codes. In the example, the FM detection mode is selected with an IF bandwidth of 6.00 kHz. The IF bandwidth byte is ignored when the detection mode byte contains codes for LSB, USB, or ISB detection modes ([00], [01], or [06]). When these detection modes are selected, the IF bandwidth is automatically set to 3.2 kHz [03].

5.6.6 **DETECTION MODE/IF BANDWIDTH COMMAND WITH ACKNOWLEDGE [06]**

**Figure 5-9** shows an example of the typical format for selecting the receiver's detection mode and IF bandwidth using control code [06]. This control code requires an acknowledgment from the controller.

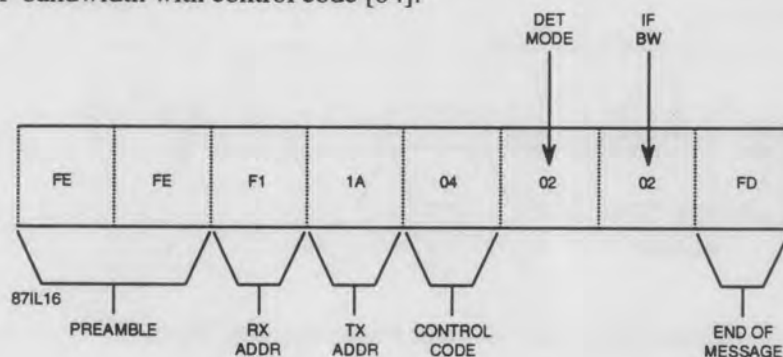


**Figure 5-9. Detection Mode/IF Bandwidth Command Format With Acknowledge**

The first byte after the control code contains the detection mode code. The second byte contains the IF bandwidth code. See control code [06] in **Table 5-1** for the detection mode and IF bandwidth choices and their codes. In the example, the FM detection mode is selected with an IF bandwidth of 6.00 kHz. The IF bandwidth byte is ignored when the detection mode byte contains codes for LSB, USB, or ISB detection modes ([00], [01], or [06]). When these detection modes are selected, the IF bandwidth is automatically set to 3.2 kHz [03].

5.6.7 **RESPONSE TO DETECTION MODE/IF BANDWIDTH REQUESTS [04]**

**Figure 5-10** shows an example of the typical response format when requesting the receiver's detection mode and IF bandwidth with control code [04].

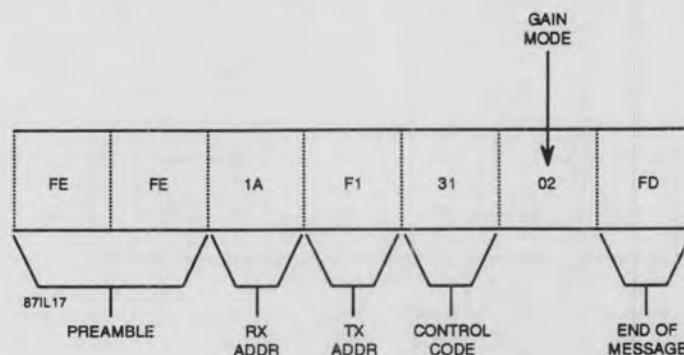


**Figure 5-10. Detection Mode/IF Bandwidth Request Response Format**

The first byte in the response contains the detection mode code and the second byte contains the IF bandwidth code. The response in the example is the AM detection mode with an IF bandwidth of 1.00 kHz. See control code [01] or [06] in **Table 5-1** for the possible responses for both bytes.

5.6.8 **GAIN CONTROL MODE COMMAND WITH ACKNOWLEDGE [31]**

**Figure 5-11** shows an example of the typical format for selecting the receiver's gain control mode using control code [31]. This control code requires an acknowledgment from the controller.

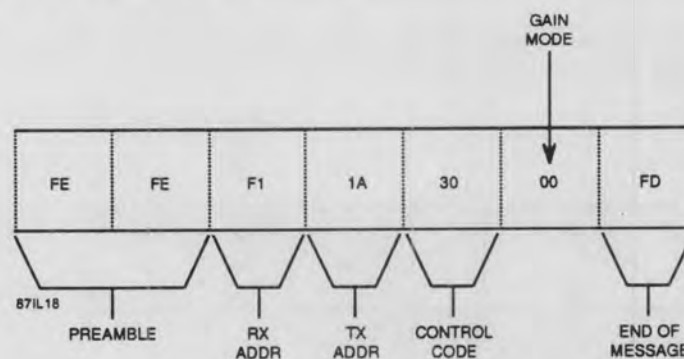


**Figure 5-11. Gain Control Mode Command Format**

One byte is sent with the control code. In the example, the fast AGC control mode is selected [02]. The selection can also be either slow AGC [01] or manual gain control [00].

5.6.9 **RESPONSE TO GAIN CONTROL MODE REQUESTS [30]**

**Figure 5-12** shows an example of the typical response format when requesting the receiver's active gain control mode with control code [30].



**Figure 5-12. Gain Control Mode Request Format**

The byte in the response after the control code contains the gain control code. The response in this byte is [00] for manual gain, [01] for slow AGC, or [02] for fast AGC. In the example, manual gain control is the response.

5.6.10 **MANUAL GAIN LEVEL COMMAND WITH ACKNOWLEDGE [33]**

Figure 5-13 shows an example of the typical format for selecting the receiver's manual gain level using control code [33]. This control code requires an acknowledgment from the controller.

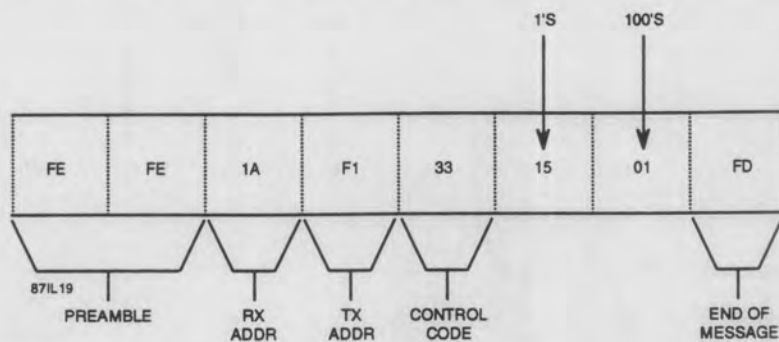


Figure 5-13. Manual Gain Level Command Format

Two bytes are sent with the control code, with the combination of both representing the value. The range is 0000 to 0127 (for 0 to 127 dB). In the example, a manual gain level of 115 dB is selected [15|01].

5.6.11 **RESPONSE TO MANUAL GAIN LEVEL REQUESTS [32]**

Figure 5-14 shows an example of the typical response format when requesting the receiver's manual gain level with control code [32].

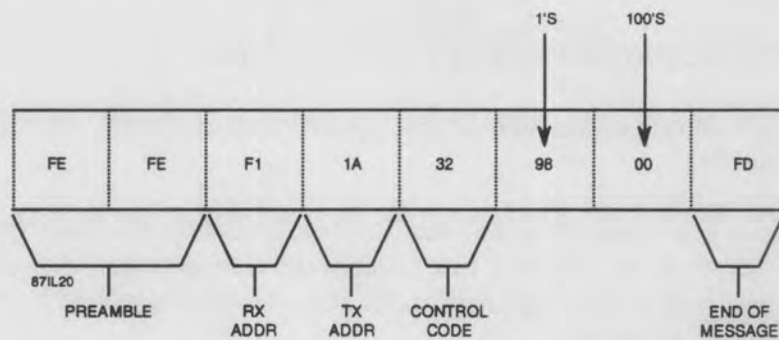


Figure 5-14. Manual Gain Level Request Format



Two bytes in the response following the control code contain the current manual gain level. The combination of the two bytes represent the value in binary coded decimal. The value can be from 0000 to 0127 (or 0 to 127 dB). In the example, the manual gain level response is 98 [98|00].

5.6.12 **BFO FREQUENCY COMMAND WITH ACKNOWLEDGE [35]**

Figure 5-15 shows an example of the typical format for sending the receiver's BFO frequency using control code [35]. This control code requires an acknowledgment from the controller.

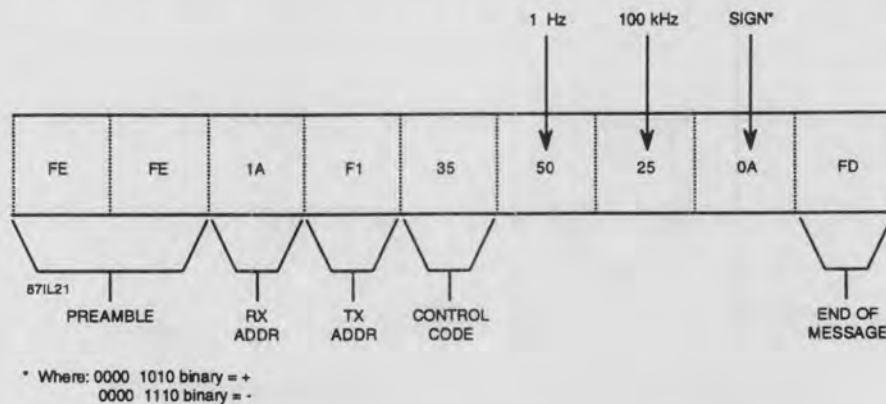


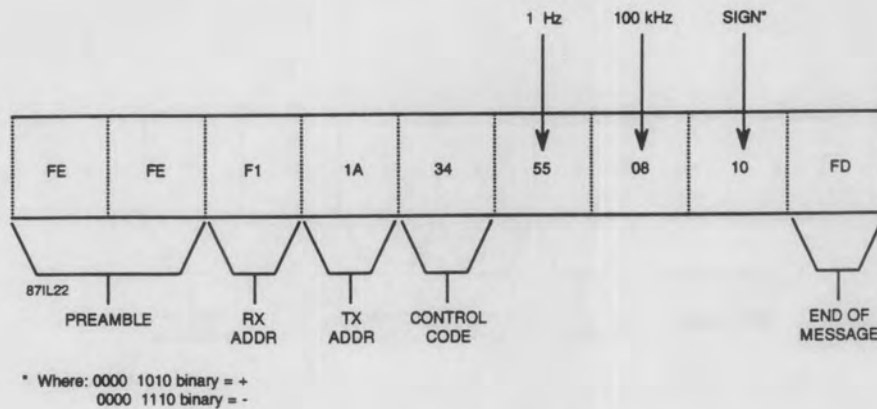
Figure 5-15. BFO Frequency Command Format

The frequency can be set to any value from +7999 to -8000 kHz at a resolution of 10 Hz. Sending +0000 sets the BFO to off. The frequency entered in the example is +2.550 kHz. The first byte of the frequency data contains Hz data. The second byte contains 100-Hz data. The third byte contains the sign, positive (+) or negative (-). For negative BFO frequencies, a hexadecimal value of [0E] should be sent in the third byte. For positive BFO frequencies, a hexadecimal value of [0A] should be sent in the third byte.

5.6.13 **RESPONSE TO BFO FREQUENCY REQUESTS [34]**

Figure 5-16 shows an example of the typical response format when requesting the BFO frequency with control code [34].

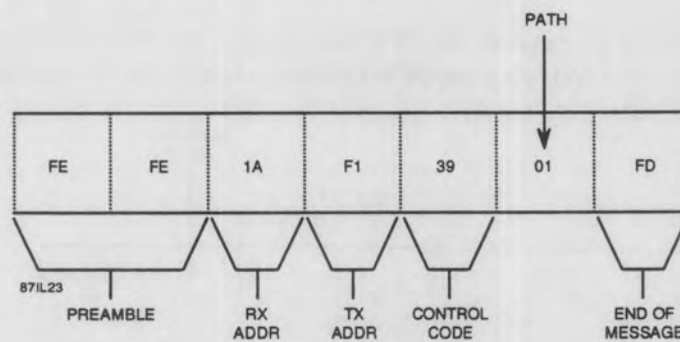
The response in the example is -855 Hz. The first byte of the frequency data contains Hz data. The second byte contains 100-Hz data. The third byte contains the sign, positive (+) or negative (-). A value of [0E] is returned in the third byte of the response when the frequency is a negative value. A value of [0A] is returned when the BFO frequency is positive.



**Figure 5-16. BFO Frequency Request Response Format**

5.6.14 **RF INPUT PATH COMMAND WITH ACKNOWLEDGE [39]**

Figure 5-17 shows an example of the typical format for selecting the receiver's RF input path using control code [39]. This control code requires an acknowledgment from the controller.

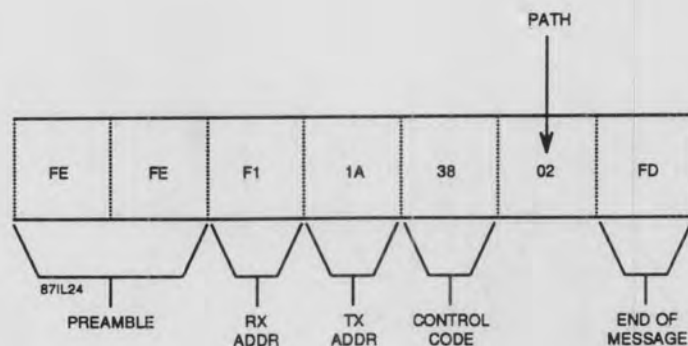


**Figure 5-17. RF Input Path Command Format**

One byte is sent with the control code. In the example, the normal RF input path is selected [01]. The selection can also be either attenuated [02] or preamplified [03].

5.6.15 **RESPONSE TO RF INPUT PATH REQUESTS [38]**

Figure 5-18 shows an example of the typical response format when requesting the receiver's current RF input path selection with control code [38].

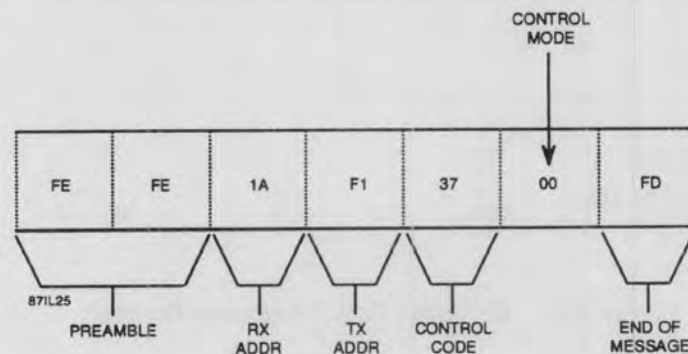


**Figure 5-18. RF Input Path Request Response Format**

The byte in the response after the control code contains the RF input path code. The response in this byte is [00] for normal, [01] for attenuated, or [02] for preamplified. In the example, the attenuated RF input path is selected.

5.6.16 **DEVICE CONTROL MODE COMMAND WITH ACKNOWLEDGE [37]**

**Figure 5-19** shows an example of the typical format for selecting the receiver's control mode using control code [37]. This control code requires an acknowledgment from the controller.

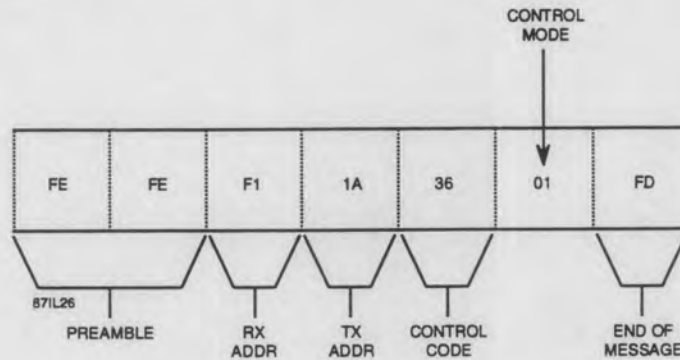


**Figure 5-19. Device Control Mode Command Format**

One byte is sent with the control code. In the example, the Local control mode is selected [00]. The selection can also be either Remote mode [01] or Remote with Local Lockout [02]. Sending [02] disables the HF-1000's front panel REMOTE key (i.e., a local operator cannot place the receiver out of Remote mode).

5.6.17 **RESPONSE TO DEVICE CONTROL MODE REQUESTS [36]**

Figure 5-20 shows an example of the typical response format when requesting the receiver's current control mode with control code [36].



**Figure 5-20. Device Control Mode Request Response Format**

The byte in the response after the control code contains the device control mode code. The response in this byte is [00] for Local, [01] for Remote, or [02] for Remote with Local Lockout. In the example, the Remote control mode is selected.

5.7 **COLLISION DETECTION**

Many different data transmitting devices can be connected on the interface along with the HF-1000. Therefore, there is always the possibility that two or more units may want to talk at the same time, causing "data collisions" on the interface..

The design of this interface is such that each device can compare what it sent to what it is receiving on the interface. That is, it receives everything that it sends simultaneously. If the receive data does not match the send data, then a collision has occurred. The data transmitting device then waits until the interface is idle and sends the jammer code shown in **Figure 5-21**.

The data transmitting device checks again for an idle interface, then sends the original message. If another collision occurs, the process is repeated until the message goes through or until the fifth repetition. After five tries, the data transmitting device discards the message. Only transmitting a new message will start the process again. If the data receiving device detects the jammer codes, the data which it receives is canceled.



**Figure 5-21. Jammer Code**

RECEIVER

DESCRIPTION

**SECTION VI**  
**CIRCUIT DESCRIPTION**



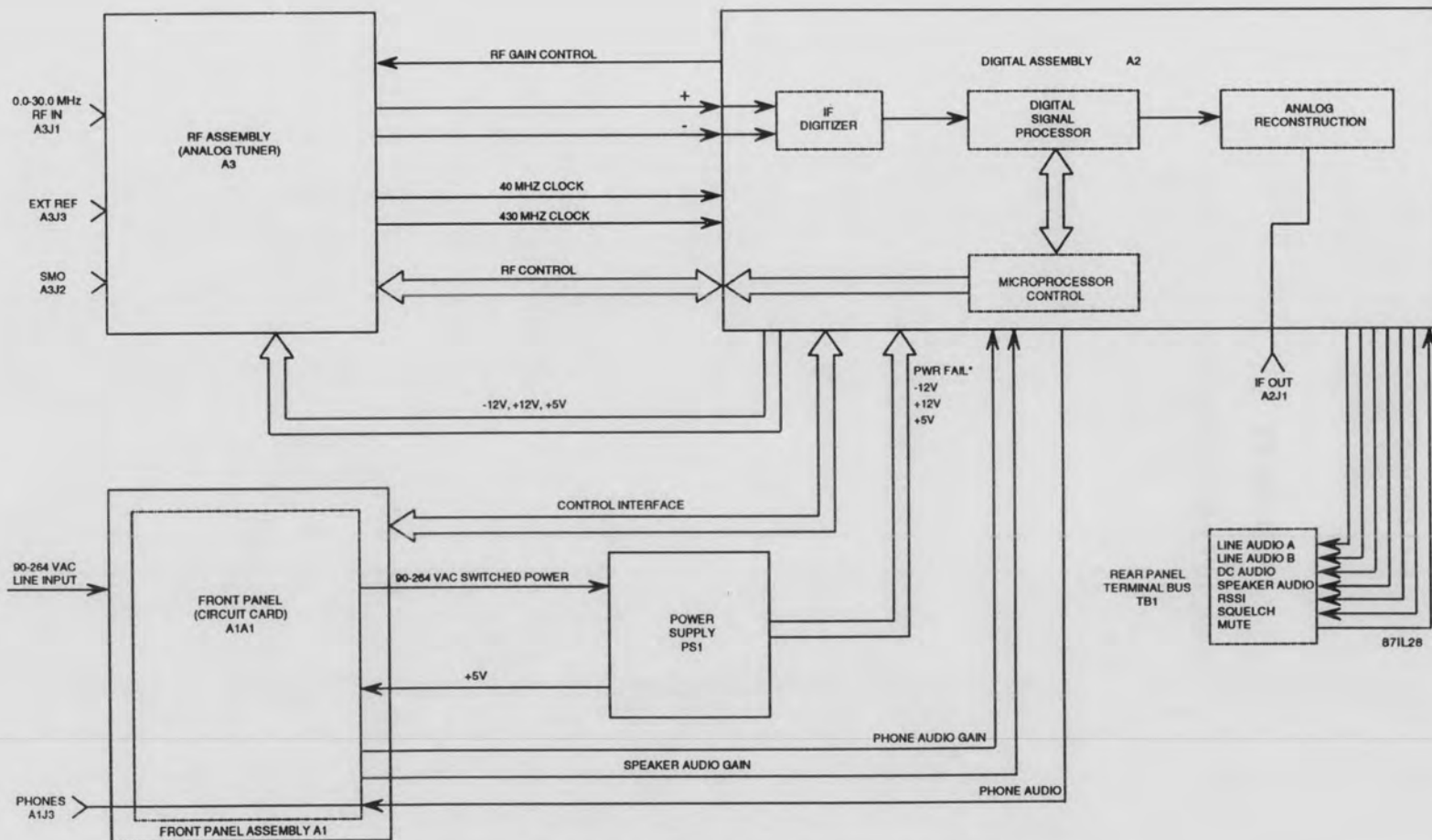


Figure 6-1. Digital HF Receiver Functional Block Diagram

## SECTION VI

## CIRCUIT DESCRIPTION

6.1 **HF-1000 DIGITAL HF RECEIVER FUNCTIONAL DESCRIPTION**

The HF-1000 Digital HF Receiver is a Digital Signal Processing (DSP) based receiver, consisting of an analog tuner, an IF digitizer, digital signal processing and analog reconstruction circuitry, and front panel control logic. These operating components are contained on three printed circuit assemblies, consisting of the Type 797006 RF Assembly (A3), the Type 797214 Digital Assembly (A2), and the Type 797015 Front Panel Assembly (A1). These three assemblies and the Type 766028 Power Supply (PS1) comprise the complete DSP based HF Receiver, as illustrated in **Figure 6-1**. Refer to the functional block diagram in **Figure 6-1** for the following description.

The Type 797006 RF Assembly (A3) functions as the analog tuner for the receiver. It performs coarse signal tuning and provides two wide band IF output signals. Three conversion stages contained in this assembly provide tuning throughout the 0 to 30.0000 MHz spectrum, with a coarse tuning resolution of 1 kHz. The RF input from the antenna enters the assembly at the rear panel RF IN connector (A3J1) and, after passing through two and three conversion stages, the tuned signal is translated into two IF outputs, respectively. The first output which is after the second conversion stage is a 455 kHz IF output, having a nominal 30 kHz bandwidth and 1-kHz resolution. It is routed directly to the rear panel Signal Monitor Output connector (SMO, A3J2). This is a 50 ohm wide band output suitable for connection of an external signal monitor. The second output which is after the third conversion stage is a 25 kHz IF output, also having a nominal 30 kHz bandwidth, that is routed to the Type 797214 Digital Assembly (A2) for digitizing and further processing. In addition to the 25 kHz IF signal, the RF Assembly provides two clock signals to the Digital Assembly. The 40 MHz and 430 kHz signals, derived from the receiver's local oscillators, are used for signal processing synchronization and analog reconstruction.

Timing and synchronization of the local oscillators in the RF Assembly are maintained by a precision 10 MHz reference oscillator contained on the assembly. The RF Assembly reference may also be locked to an external frequency standard by connecting the external 1, 2, 5, or 10 MHz signal at the rear panel EXT REF connector (A3J3). The connection of the external reference is automatically sensed and locks the reference oscillator to the external source.

The Type 797214 Digital Assembly (A2) functions as the IF Digitizer, Digital Signal Processor, and Analog Reconstruction circuit for the receiver. It also contains the microcontroller circuitry that maintains control over all receiver operations. The Digital Assembly accepts the 25 kHz IF signal from the RF Assembly, digitizes the signal, and using Digital Signal Processing (DSP) techniques, performs the majority of the signal processing operations required to produce the final outputs. The DSP circuitry on this assembly converts the digitized IF signal from a continuous time domain signal into discrete time samples that can be stored in random access memory and processed digitally to perform a wide range of operations, normally associated with analog circuitry, such as:

- Receiver Fine Tuning to a 1 Hz resolution,
- IF Bandpass Filtering,
- Determination of Input Signal Strength,

- Receiver Gain Control,
- Signal Detection and Demodulation,
- Noise Blanking.

Upon completion of the signal processing, a serial data stream representing the receiver's bandpass filtered IF signal, and the demodulated audio extracted from the tuned signal are routed to the Analog Reconstruction circuitry. The Analog Reconstruction circuitry converts the digital data back to its analog form, separates the audio and IF signals, provides post filtering, and, after completion of the analog reconstruction, provides the final audio and post filtered IF outputs. The reconstructed IF signal is converted up to 455 kHz and is provided at the rear panel IF OUT connector (A2J1) for external use. This 50 ohm output provides the 455 kHz IF at a level of approximately -20 dBm (AGC active), with its bandwidth determined by the operator selected IF bandwidth.

The reconstructed audio is separated into left and right channels and is then directed to the various receiver audio outputs. The unit's internal speaker provides the receiver the capability to produce audible audio when external speaker sources are not available. An 8 ohm, 4-inch speaker is mounted on the top cover of the receiver. The phone audio is routed to the front panel PHONES jack (A1J3) via the Front Panel circuit card assembly (A1A1). The audio signal is also provided to the rear panel terminal bus (TB1). The LINE A and LINE B audio outputs are 600 ohm balanced audio outputs, and the SPEAKER output is an unbalanced 8 ohm output. The final audio output is the DC AUDIO, which is a DC coupled, unbalanced, 1 kohm output.

The Type 797214 Digital Assembly also contains a microcontroller that provides an interface between an external controlling device and the receiver circuitry. Two serial control interfaces are provided to the rear panel to permit receiver control by either an RS-232 or CSMA compatible computer via A2J3 or A2J2, respectively. Only one control interface can be active at one time.

Operating power is supplied to all of the assemblies in the HF-1000 Receiver by the Type 766028 Power Supply (PS1). This assembly accepts the incoming line voltage and converts it to the DC voltages required for proper receiver operation. It accepts an AC input ranging between 100 and 254 VAC and provides the -12 V, +12 V, GND, and +5 V outputs to the operational assemblies.

## 6.2 CIRCUIT DESCRIPTIONS

### 6.2.1 TYPE 797006 RF ASSEMBLY, (A3)

The Type 797006 RF Assembly (A3) functions as the RF tuner for the HF-1000 Digital HF Receiver. It receives a 0 to 30.0000 MHz input spectrum from the RF signal source and provides RF tuning to extract the signal of interest from the input spectrum. The signal of interest is converted to 455 kHz and 25 kHz IF signals that are provided as outputs for further processing. Refer to the Type 797006 RF Assembly Block Diagram in **Figure 6-2** as a reference for the following module description. For a more detailed illustration of the RF Assembly circuitry, refer to the Type 797006 RF Assembly schematic diagram, **Figure 9-2**.

The RF Assembly consists of an RF Input circuit, three Mixing stages for signal conversion, a highly stable reference generator, and three local oscillators. These module sections interconnect as illustrated in **Figure 6-2** to produce the required outputs.



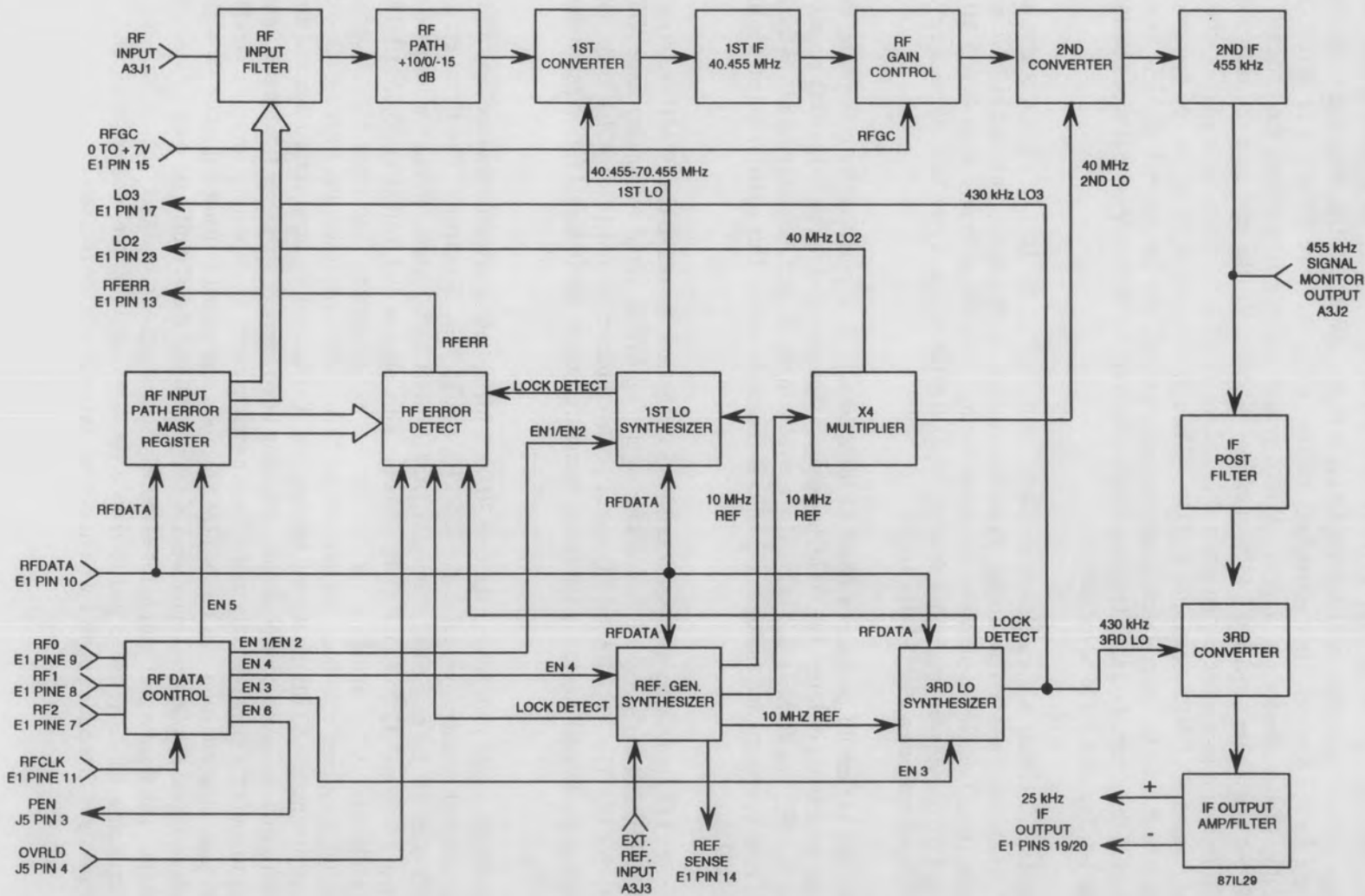


Figure 6-2. Type 797006-1 RF Assembly Block Diagram

HF-1000 DIGITAL HF RECEIVER

CIRCUIT DESCRIPTION

## CIRCUIT DESCRIPTION

## HF-1000 DIGITAL HF RECEIVER

The reference generator uses a phase-locked-loop synthesizer to control a temperature compensated, voltage controlled crystal oscillator, producing a highly stable 10 MHz reference signal that is used as the time base for the receiver. In the standard receiver, using the Type 797006-1 or 797006-3 RF Assembly, the stability of the reference is .7 ppm. Where greater stability is required, the optional Type 797006-2 and 797006-4 assemblies provide 0.2 PPM stability. Additionally, the reference generator may be locked to an external reference by connecting an external 1, 2, 5, or 10 MHz reference signal, at a level of 200 mV rms, at the rear panel EXT REF connector (A3J3). When an external input at one of the specified frequencies is present at this input, its presence is automatically sensed, and the internal 10 MHz reference generator phase-locks to the external signal. The phase-locked internal 10 MHz reference is then provided as the time base for the 1st, 2nd, and 3rd local oscillators.

The 1st LO circuit is a translation oscillator, comprised of the 1st LO VCO, a coarse tuning phase-locked-loop synthesizer, and a fine tuning phase-locked-loop synthesizer. The combined circuitry produces the variable 1st LO output, used to provide signal tuning. The output ranges from 40.455 MHz to 70.455 MHz for tuned frequencies ranging from 0.0000 to 30.0000 MHz, respectively. This output is provided to the first mixer (U28) to produce a 40.455 MHz 1st IF.

The 2nd LO circuit produces a fixed 40 MHz output. It is produced by multiplying the 10 MHz reference signal by a factor of four. The 40 MHz output is then provided to the 2nd mixing stage (U30) to produce 455 kHz 2nd IF. The 40 MHz 2nd LO is also provided to the Digital Assembly for use as the time-base for the control microprocessor and analog to digital conversion circuitry. This signal is output via pin 23 of connector A3E1 (LO2).

The 3rd LO circuit uses a phase-locked-loop synthesizer, locked to the 10 MHz reference, to produce the fixed 430 kHz 3rd LO signal. This 430 kHz signal is provided to the 3rd mixing stage (U31) to produce the 25 kHz 3rd IF. The 430 kHz 3rd LO signal is also directed via pin 17 of A3E1 to the Digital Assembly. It is used in the Digital Assembly for analog reconstruction of the IF signal for output to the rear panel IF OUT (A2J1).

The RF/IF signal path accepts the 0 to 30.0000 MHz input spectrum, provides input filtering, and using multiple conversion stages, produces the 455 kHz and 25 kHz IF outputs. The signal enters the assembly via the 50 ohm RF IN rear panel connector (A3J1). The signal passes through a lowpass input roofing filter, having a nominal 32 MHz cutoff frequency. This permits the 0.5000 to 30.0000 MHz HF spectrum to pass while attenuating signals above the receiver tuning range. The input filtering provides improved IF and image frequency rejection. Beyond the 32 MHz cutoff frequency, the filter response drops sharply, providing approximately 80 dB of ultimate attenuation. The filtered RF input is then directed through a selectable front end gain/attenuation control circuit, providing three operator selectable front end settings. It permits the operator to route the signal directly to the 1st conversion stage, or, depending on signal conditions, introduce front end gain or attenuation. In the NORMAL mode, the signal is passed directly through this circuit with no effect on signal amplitude. Under weak signal conditions, the +10 dB gain path provides 10 dB of signal amplification. The third signal path is for extremely strong signal conditions. The -15 dB selection passes the signal through a 15 dB resistive pad to reduce the signal entering the receiver front end. This attenuation pad is capable of dissipating up to 1 watt to provide protection at the receiver input.

The 1st stage of conversion consists of a high intercept mixer that mixes the RF spectrum with the 1st LO signal, ranging from 40.455 MHz (0.0000 MHz Tuned Frequency) to 70.455 MHz (30.0000 MHz Tuned Frequency). The mixer output is amplified and bandpass filtered to select the 40.455 MHz difference frequency. The 1st IF filter provides a 30 kHz bandpass, centered at 40.455 kHz.

After IF filtering and amplification, the 40.455 kHz IF signal is directed to the second conversion stage, via a voltage controlled attenuator. This circuit provides control over the amplitude of the signal to the proper output level, preventing overloading of the analog to digital converter stage in the Digital Assembly. The RF GAIN input at pin 15 of connector E1 is provided by the control processor in the Digital Assembly (A2). It is the result of the DSP microprocessor sampling the value of the signal level after digitization. This voltage ranges from 0 to +7 V, providing approximately 60 dB of gain control. This voltage is strictly dependent on the signal level and is independent of the receiver's AGC or manual gain setting.

The 2nd conversion stage mixes the signal with the fixed 40 MHz 2nd LO signal, producing the 455 kHz 2nd IF. After filtering to remove the undesired mixing products, the IF signal is split into two paths. The first path directs the 455 kHz IF out to the rear panel Signal Monitor Output (SMO) connector (A3J2). This provides a 50 ohm output at a level of approximately 30 dB greater than the RF Input at the RF IN connector (A3J1). The Signal Monitor Output bandwidth is approximately 30 kHz wide.

The second signal path for the 2nd IF signal is through the third stage of conversion. The signal is mixed with the 430 kHz 3rd LO signal, producing the 25 kHz 3rd IF signal. After filtering, the 25 kHz IF is output, via pins 19 and 20 of connector E1, to the Digital Assembly for digitization and further processing. It is a differential output, having a level approximately 53 dB greater than the RF input. The bandwidth is approximately 25 kHz.

All control over the operation of the Type 797006 RF Assembly is performed by the Digital Assembly via pins 7 through 15 of connector A3E1. Connector E1 pin 15 provides a 0 to +7 V level, controlling the gain of the RF signal path. It is the result of sampling of the IF signal level after digitization. The remaining pins are used for monitoring the RF Assembly operation and sending control data for tuning and setting RF front end Gain/Attenuation selection.

The PRE/OPT (pin 12), RF ERR (pin 13), and REF SENSE (pin 14) are all outputs from the RF assembly to the Digital Assembly. They provide the control microprocessor with the operating status. The PRE/OPT line (pin 12) indicates when the HF-1000/PRE optional Preselector is installed in the receiver. When the optional preselector assembly is present, it sets this line to logic "1", indicating to the control microprocessor that it must send preselector control data whenever the receiver is tuned. If the option is not installed, the PRE/OPT line is held at logic "0".

The REF SENSE line (pin 14) provides an indication when an external reference is connected at the rear panel EXT REF connector (A3J3). When an external reference is connected, it causes this line to assume a logic "0" condition. The control microprocessor then tunes the reference phase-locked-loop synthesizer to each of the allowable reference input frequencies, until the reference synthesizer locks on external input. If no external reference is present, the REF SENSE line remains at logic "1" and the internal reference provides the receiver time-base.

The RF ERR line (pin 13) provides the control microprocessor with an indication of the operating status of the phase-locked-loop synthesizers in the RF assembly. When the optional preselector is installed in the receiver, this line also monitors the overload protection circuitry in the preselector and activates this line during signal overload conditions. The synthesizer lock lines of the Reference, 1st LO and 3rd LO synthesizers are ORed together, along with the preselector overload line. Any synthesizer unlock or signal overload condition causes this line to assume a logic "0" condition. Once flagged by the RF ERR line, the microprocessor individually masks each of the RF ERR controlling inputs to determine the error source and reports the appropriate error condition.

Control of the RF assembly is provided via the RF0, RF1, RF2, RF DATA, and RF CLK lines (pins 7 through 11). The RF DATA line (pin 10) carries serial data from the control microprocessor to the various controlled circuits in the RF and optional Preselector Assemblies. The data is sent as a series of 8-bit data words synchronized with the data clock present on the RF CLK line (pin 11). The RF DATA line is shared by six controlled circuits each of which acts on the data only when instructed by the microprocessor via the RF0, RF1, and RF 2 control lines. These lines determine the destination of the data. **Table 6-1** lists the states of the data control lines and the associated data.

**Table 6-1. RF Data Control**

RF2	RF1	RF0	Strobe	Data Type
0	0	0	EN1	1st LO Fine Loop Tuning Data.
0	0	1	EN2	1st LO Coarse Loop Tuning Data.
0	1	0	EN3	3rd LO Tuning Data.
0	1	1	EN4	Reference Oscillator Tuning Data.
1	0	0	EN5	BITE/NORM/PREAMP/ATTEN Data.
1	0	1	EN6	Optional Preselector Band Select Data.

### 6.2.2 TYPE 797214 DIGITAL ASSEMBLY, (A2)

The Type 797214 Digital Assembly (A2) consists of three major operating sections: the Control and Interface section; the Digital Signal Processing section; and the Reconstructed Analog Section. These sections perform the IF digitization, Digital Signal Processing, Analog Reconstruction, and Receiver Control functions associated with the operation of the HF-1000 Digital HF Receiver. The assembly also provides an interface with an external computer, or other external controlling devices, and performs the control and monitoring functions that direct the receiver operation. Refer to the Type 797214 Digital Assembly Block Diagram in **Figure 6-3** as a reference for the following assembly description. For a more detailed illustration of the Digital Assembly circuitry, refer to the Type 797214 Digital Assembly Schematic Diagram, **Figure 9-1**.

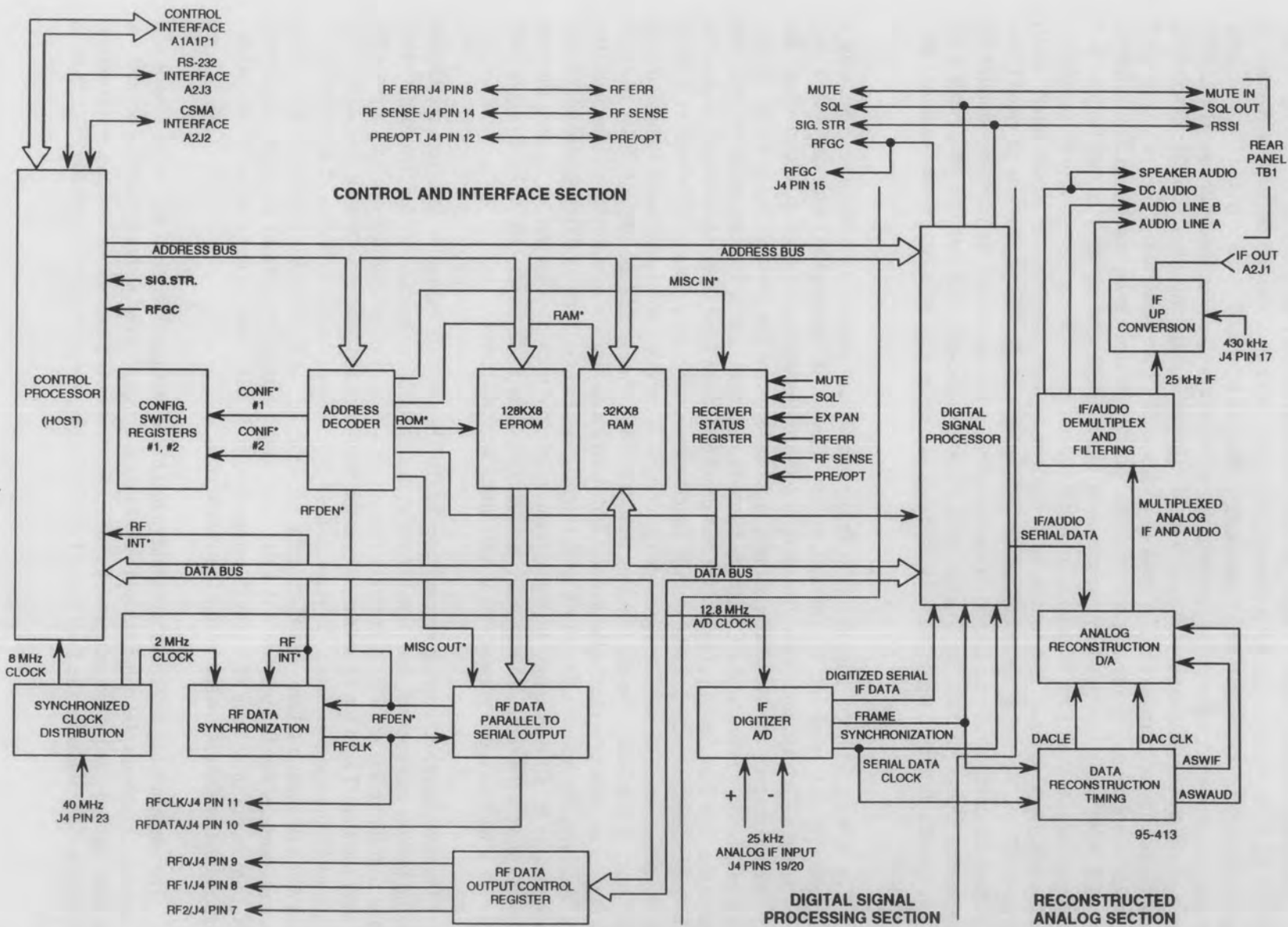


Figure 6-3. Type 797214-1 Digital Assembly Functional Block Diagram

HF-1000 DIGITAL HF RECEIVER

CIRCUIT DESCRIPTION

## CIRCUIT DESCRIPTION

## HF-1000 DIGITAL HF RECEIVER

Under the direction of the Control and Interface section, the Digital Signal Processing section takes the analog IF signal supplied by the RF Assembly, digitizes it, and processes the digitized signal data to extract the signal intelligence. Other than the signal tuning performed by the RF Assembly, the Digital Signal Processing section performs all of the receiver functions that ultimately produce the final outputs. The 25 kHz IF input enters the Digital Assembly at pins 19 and 20 of J4. This differential input has a 25 kHz bandwidth, and ranges in level from approximately .1 to .7 V peak-to-peak at each of the input pins. The signal is directed into the IF Digitizer where the analog signal is converted into digital data that can be read by the Digital Signal Processor. A 12.8 MHz clock, provided by synchronized clock distribution circuitry in the Control and Interface section provides the timing for the analog-to-digital conversion. It causes the signal to be sampled at a 100 kHz rate, producing a series of data frames, each representing one sample of the analog input. Each frame is made up of 32 data bits, 16 of which contain the digitized IF sample. The samples are provided to the DSP circuitry where the continuous time domain signal samples are converted into discrete time samples for continuous processing. Using this data, the Digital Signal Processor, digitally performs fine tuning to a 1 Hz resolution, IF bandwidth filtering, signal strength calculations, signal demodulation, noise blanking, and receiver gain control.

The outputs from the Digital Signal Processing section consists of serial data containing a digital representation of the receiver's IF (limited to the selected IF bandwidth), and detected audio, multiplexed into a single data stream. This data is routed to the Reconstructed Analog section where the signals are separated, converted back to analog signals, and output to the rear panel of the receiver. It also provides analog and digital outputs to the Control and Interface section, and to the rear panel terminal bus (TB1) for monitoring. The Squelch output line at the rear panel provides a logic level that indicates to external equipment if a tuned signal exceeds the programmed Squelch level. It is set to logic "0", whenever a tuned signal exceeds the programmed level. The signal strength output is provided at the rear panel terminal bus as the RSSI output line. It is an analog voltage ranging from 0 to +5V, representing the strength of the received signal. These outputs are also provided to the Control and Interface section for monitoring. Additionally the Digital Signal Processing section provides an RF gain control output to the Type 797006 RF assembly (A3). This output is a result of the DSP sampling the signal level at the input to the IF Digitizer. It controls the gain of the RF section to prevent the signal from over driving the input of the IF Digitizer. The voltage ranges from approximately +7.0 V with no signal present to 0 V with strong signals present.

The Reconstructed Analog section receives the Digitized IF and audio data from the Digital Signal Processing section and converts the signals back to analog form for output. In addition to the serial data, the Digital Signal Processing section provides frame synchronization and serial data clock signals for timing of the data transfer. These timing signals permit the Reconstructed Analog section to demultiplex the signals into separate IF and audio signals. The reconstructed IF signal, converted back to a 25 kHz analog IF, is mixed with a 430 kHz local oscillator signal from the RF Assembly (A3), provided via pin 17 of J4. This mixing process up-converts the IF signal to 455 kHz. The signal is then provided to rear panel connector A2J1. This 50 ohm output provides a 455 kHz IF output, limited in bandwidth to the selected IF bandwidth. The level is approximately -20 dBm when loaded into 50 ohms.

The reconstructed audio is filtered and routed to the rear panel terminal bus as the Line A and Line B audio outputs. These are 600 ohm balanced outputs for use with external audio monitoring devices. A DC Audio output is also provided at the rear panel terminal bus. It is an unbalanced, DC coupled audio output. The final audio output is provided to the front panel PHONES jack, via the Type 383076 Power Distribution Assembly (A1).

The Control and Interface Section directs the operation of the Type 797006 RF Assembly (A3) and it directs the operation of the functions performed by the Digital Signal Processing Section, contained on this assembly.

The heart of the Control and Interface Section is the 68HC11 microcontroller. It continuously monitors the receiver functions and provides control data to direct its operation. On receiver power up, the control processor enters into a power up routine that checks the two banks of configuration switches to properly configure the external control interfaces for communication with external controlling devices, and it performs a built-in-test (BITE) operation to verify proper operation of key receiver parameters. Once the configuration and testing have been completed, the microcontroller then directs control data to the RF Assembly and the Digital Signal Processing section to set the receiver parameters for operation. The communication with the Digital Signal Processing section is via the microcontroller's address and data buses. It consists of data that determines the parameters that the Digital Signal Processor uses in processing of the tuned signal.

The transfer of control data to the RF section is performed through a ribbon cable connected at J4. This data (RF DATA) is transferred serially as a sequence of 8-bit data words, via J4 pin 10, and provides the data to five control registers in the RF Assembly that: phase locks the receiver time base; tunes the RF Assembly to the desired frequency; and selects the NORMAL, PREAMPLIFIED, or ATTENUATED RF Input Path. Three control lines (RF0, RF1, and RF2) are set as each data word is transferred, determining the destination of the data after it reaches the RF Assembly. These control lines form a three bit address via pins 9, 8, and 7 of J4, respectively, which are decoded by the RF Assembly to properly direct the data transfer (refer to **Table 6-1**). The RF DATA, and the RF0, RF1, and RF2 Control lines are synchronized with the RF clock (RFCLK), J4 pin 11. This is a sequence of 8 bit clock bursts that provide timing for the data transfer.

Three status lines, provided via connector J4, are monitored by the Control Section to determine the operating status of the RF assembly. They are routed to a receiver status input register, and are checked periodically to verify proper operation and to determine if any control action is to be taken. The RFERR status line provides a logic level to notify the Control section if an error condition occurs. With an external reference connected to the receiver rear panel, and, with all of the phase-locked-loop synthesizers in the RF Assembly locked and operating normally, the RFERR line provides a constant logic "1". If any of the synthesizers fail, the unlocked synthesizer causes a logic "0". If no external reference is connected to the receiver rear panel, the internal reference is active, and logic "0" pulses occur at intervals of approximately 8 msec. Also, if the receiver is equipped with the RF Preselector option, a signal overload will result in a logic "0" on the RFERR line.

The Control and Interface section timing is synchronized with the receiver's time base by a 40 MHz signal, provided by the RF Assembly via J4 pin 23. This signal enters the synchronized clock distribution circuitry of the Control and Interface section, where it is used to generate an 8 MHz clock for the microcontroller, a 2 MHz clock to provide timing for transferring control data to the RF Assembly, and the 12.8 MHz clock for timing of the analog-to-digital conversion in the IF digitizer.

Three methods of control of the receiver operation are supported by the Control and Interface section. The RS-232 interface provides a communications link from the microcontroller to a 25 pin RS-232 connector at the receiver rear panel (A2J3). This is a three wire configuration that permits talk and listen capabilities, using RS-232 levels. The CSMA interface provides limited receiver control capabilities. The Carrier Sense Multiple Access is a two wire bidirectional interface that provides limited control using TTL logic levels. This interface provides a communication link via a mini phone jack at the rear panel (A2J2). The third form of receiver control is via the Control Interface output (A2J7). This interface is routed to the Front Panel Assembly circuit card via a 24 conductor ribbon cable attached to A1A1E7.

### 6.2.3 TYPE 797015-1 FRONT PANEL ASSEMBLY (A1)

The Type 797015-1 Front Panel Assembly (A1) consists of a power switch assembly (S1) with a power on indicator (DS1), a stereo phones jack (J1), and a Front Panel circuit card assembly (A1). The front panel circuit card assembly contains; a microcontroller, three encoders, numerous switches and indicators and their associated decoding and driving circuits, and both gain controls for the PHONES and SPEAKER audio outputs. This assembly provides the man/machine interface to the HF-1000 Digital HF Receiver. Refer to the Type 797015-1 Front Panel Assembly Functional Block Diagram in **Figure 6-4** as a reference for the following assembly description. For a more detailed illustration of the Front Panel Assembly circuitry, refer to the Front Panel Schematic Diagram, **Figure 9-3**.

The Control Processor (A1A1U1) on the Front Panel circuit card is connected directly to the Control Processor on the Digital Assembly (A2) via a tri-state octal buffer and a CMOS Hex buffer (A1A1U18). These two microcontrollers operate in a Master/Slave configuration, where the Master controller is on the Digital Assembly (A2). A full-duplex serial data path is provided by the MOSI (Master-Out-Slave-In) and MISO (Master-In-Slave-Out) lines, on connector E7 pins 6 and 7 respectively.

Any operations performed on the front panel such as changing the setting of one of the three encoders, adjusting the manual gain potentiometer, or changing the position of any of the front panel switches, causes the control processor to assert the Front Panel Interrupt (FPINT\*) signal at E7 pin 9. The master control processor on the Digital Assembly (A2) responds by reading the registers of processor (A1A1U1) and asserting the Front Panel Acknowledge (FPACK\*) signal at E7 pin 8.

Whenever the receiver is performing an operation under the control of the Digital Assembly's control processor such as sweeping or scanning, the frequency data is fed to the front panel slave processor via the MOSI data line and appears on the FREQUENCY MHz display in real time.

### 6.2.4 TYPE 766028-1 POWER SUPPLY ASSEMBLY, (PS1)

The Type 766028-1 Power Supply, illustrated in the HF-1000 Digital HF Receiver Main Chassis schematic diagram, **Figure 9-4**, provides the voltages required for the proper operation of the HF-1000 Receiver.



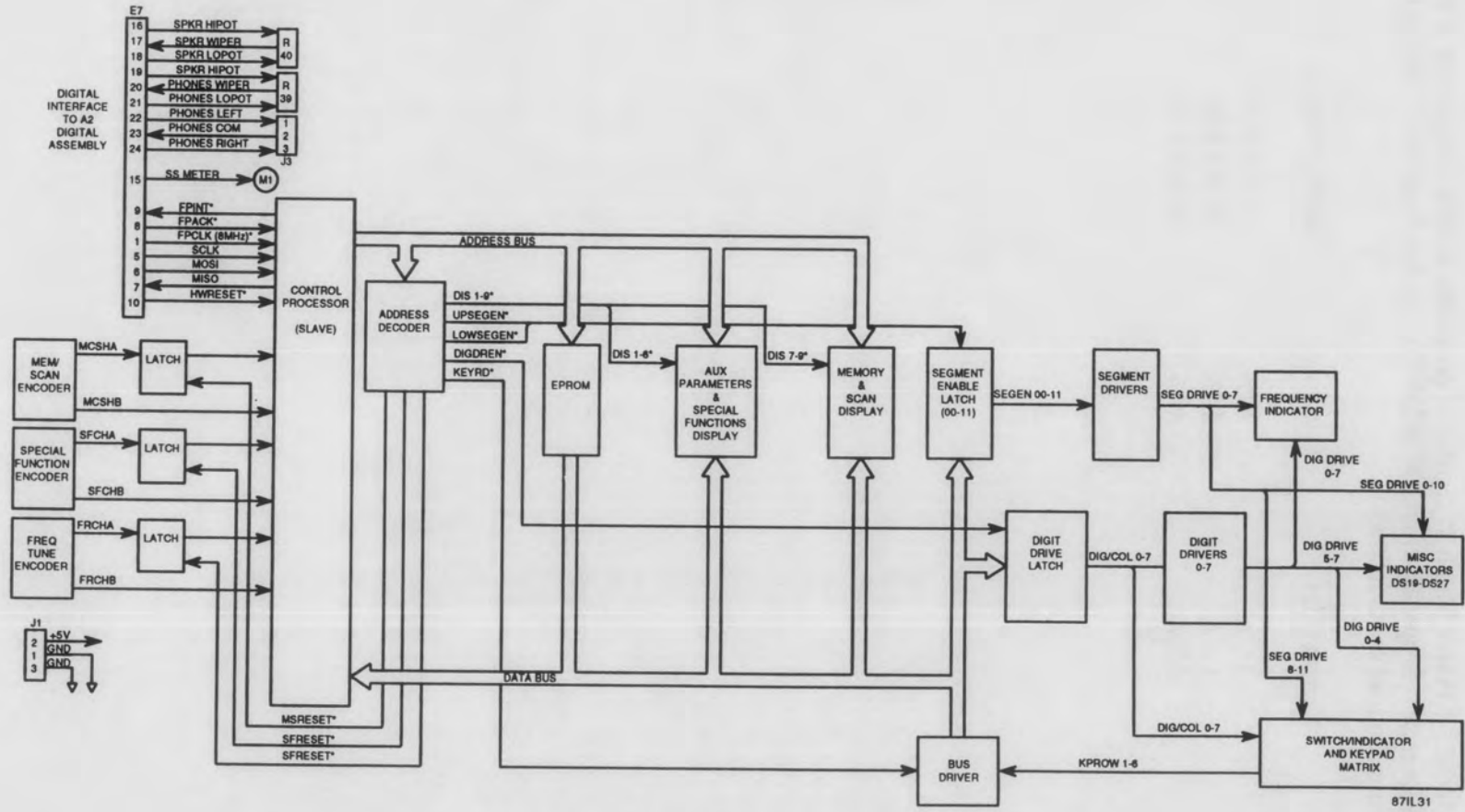


Figure 6-4. Type 797015-1 Front Panel Assembly Functional Block Diagram

## CIRCUIT DESCRIPTION

## HF-1000 DIGITAL HF RECEIVER

The Type 766028-1 Power Supply is capable of providing reliable outputs over a wide range of input line voltages and frequencies. It operates from 100 to 254 VAC, at line frequencies ranging from 47 to 440 Hz. The voltage outputs under load are as follows:

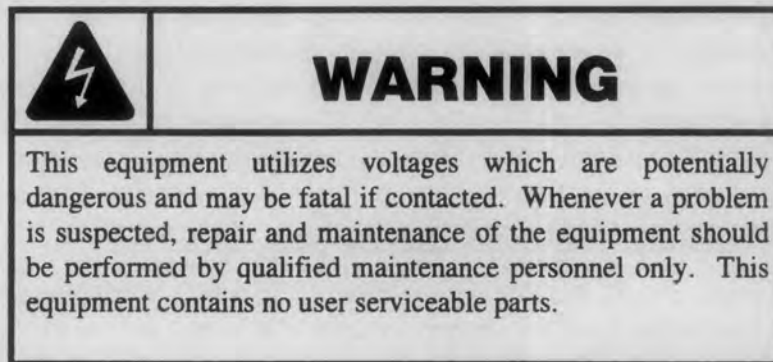
Voltage	Current (Max.)	Tolerance	Ripple (Max.)
+5 V	3.0 A	$\pm 2\%$	50 mV P-P
+12V	1.5 A	$\pm 4\%$	50 mV P-P
-12V	0.5 A	$\pm 4\%$	50 mV P-P

**SECTION VII**  
**MAINTENANCE**

## SECTION VII MAINTENANCE

### 7.1 GENERAL

The HF-1000 Digital HF Receiver has been designed to operate for extended periods of time with a minimum of routine maintenance. Cleaning, inspection and performance tests should be performed at regular intervals, consistent with the facility's normal scheduling and after repairs have been made. The only alignment procedure required for the HF-1000 is for the Reference Frequency Timebase Accuracy, and shall only be performed on an as needed basis.



### 7.2 PREVENTIVE MAINTENANCE PROCEDURES

Preventive maintenance procedures for the receiver consist of both cleaning and scheduled preventive maintenance procedures.

#### 7.2.1 CLEANING AND LUBRICATION

The receiver should be kept free of dust, moisture, grease and other foreign matter to ensure trouble-free operation. Use low pressure air, if available, to remove accumulated dust from the interior of the receiver. A clean, dry cloth or soft bristled brush may also be used for this purpose. No lubrication is required.

#### 7.2.2 SCHEDULED PREVENTIVE MAINTENANCE PROCEDURES

Component A2U5 is a plug-in chip that furnishes battery power (V Batt) for the Digital Control PC Assembly (A2). U5 should be changed every eight years, or more frequently if local preventive maintenance procedures dictate. Refer to **paragraph 7.18.15** for RAM/Battery (A2U5) removal and replacement procedures.

### 7.3 INSPECTION FOR DAMAGE AND WEAR

Many existing or potential troubles can be detected by making a thorough visual inspection of the unit. For this reason, as a first step in troubleshooting, a complete visual inspection should be made whenever the unit is inoperative. Inspect mechanical parts such as pin connectors and interconnecting cables for looseness, wear and other signs of deterioration. The circuit card assemblies should be checked to assure that they are properly secured to the chassis and making good electrical contact. Electronic components that show signs of deterioration, such as overheating, should be inspected and a thorough investigation of the associated circuitry should be made to verify proper operation. Often, damage due to heat is a result of other, less apparent problems in the circuit.

7.4 **TEST EQUIPMENT REQUIRED**

Procedures for testing the HF-1000 Receiver have been developed for performance using a minimum of common test equipment. The test equipment listed in **Table 7-1**, or equivalents, are required to perform the troubleshooting and alignment procedures, along with the performance tests described in this section.

7.5 **TROUBLESHOOTING AND FAULT ISOLATION**

The test procedures that are provided in this section verify proper receiver operation and assist in fault isolation to a malfunctioning assembly. They have been developed to set known laboratory conditions that eliminate external conditions as a possible cause of the malfunction. Use performance tests in **paragraph 7.6**, and the circuit descriptions in **Section VI** to assist in fault isolation. The loss of stored parameters between receiver power-ups may be the result of the failure of the RAM/Battery chip (A2U5). Refer to **paragraph 7.8.15** for RAM/Battery (A2U5) removal and replacement procedures.

7.6 **HF-1000 DIGITAL HF RECEIVER PERFORMANCE TESTS**

The performance tests that follow are designed to verify proper operation of the HF-1000 Receiver, and each of its operational modules. In performance of the tests, the receiver may be controlled by the front panel controls or by an external controlling computer, connected to the rear panel RS-232 connector, A2J3. Each procedure provides sufficient set up information to accommodate either control method.

**Table 7-1. Required Test Equipment**

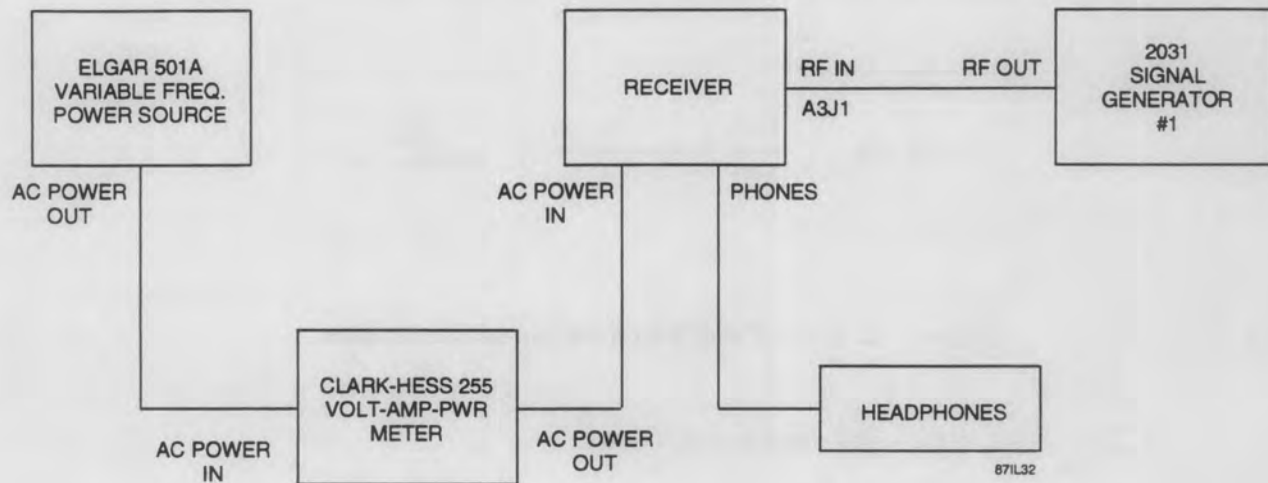
Equipment	Recommended Type	Requirement
Variable Frequency Power Source	Elgar 501A	Voltage Range - 90 to 264 VAC Frequency Range - 47 to 440 Hz
Volt-Amp-Power Meter	Clark-Hess 255	Power Measurement
Signal Generator (Qty 2)	Marconi 2031	Frequency Range to 30 MHz Internal Modulation Capability
Frequency Counter	Fluke 1953A	Frequency Range to 100 MHz
RF Millivoltmeter	Boonton 92B	dB Scale Referenced to 50 Ohm Load
RF Probe	Boonton 91-12F	
"T" Adapter	Boonton 91-14A	
50 Ohm Termination	Boonton 91-15A	
AC Voltmeter	HP-400EL	dB Scale Referenced to 600 Ohm Load
Distortion Analyzer	HP-334A	Harmonic Distortion Measurement
Digital Voltmeter	Fluke 8001A	AC/DC Voltage Measurement
Oscilloscope	Tektronix 2236	100 MHz Frequency Response
Control Computer (Optional)	IBM PC Compatible	RS-232 Compatible
Headphones	TELEX PH-6	600 ohm, stereo (2-channel with 1/4" tip-ring jack)

7.6.1 **POWER CONSUMPTION**

1. Connect the HF-1000 Receiver and test equipment as illustrated in **Figure 7-1**.
2. Set the Clark-Hess Volt-Amp-Wattmeter function to the power mode, with the 500 ma current range selected. Set the voltage range as required for the line voltage being tested.
3. Adjust the Variable Frequency Power Source to the line frequency and voltage at which the receiver is to be operated.

**NOTE**

Power requirements for the HF-1000 Receiver range from 100 to 254 VAC, with a line frequency ranging from 47 to 440 Hz.



**Figure 7-1. Power Consumption Performance Test Equipment Connection**

4. Set the Signal Generator to produce a 1.0000 MHz output at a level of -90 dBm. Set the generator modulation for 400 Hz AM, 50% modulation.
5. Apply power to the receiver and set the receiver parameters as follows:

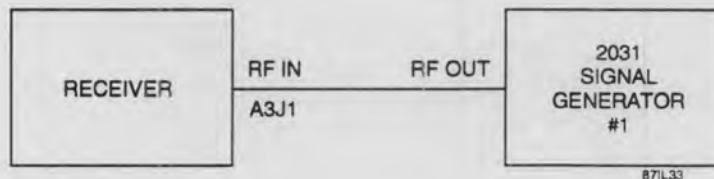
Tuned Frequency:	1.000000 MHz	FRQ 1 <Return>
Detection Mode:	AM	DET 1 <Return>
IF Bandwidth:	6.0 kHz	BWS 4 <Return>
Gain Control:	AGC Fast	AGC 2 <Return>
Squelch:	Off	SQL 136 <Return>

6. Adjust the PHONES LEVEL control for a clear 400 Hz audio tone in the headphones.
7. Verify that the power consumption level displayed on the Volt-Amp-Wattmeter does not exceed 40 Watts.
8. Slowly increase and decrease the Variable Frequency Power Source by 10% of the initially set value while observing the power consumption level on the Volt-Amp-Wattmeter. Verify that the power consumption throughout the  $\pm 10\%$  range remains at 40 Watts or less and a clear audio tone remains present in the headphones.
9. Slowly decrease the Variable Frequency Power Source output voltage until the audio tone cuts off, indicating that the receiver has shut down. Verify that the line voltage at shut down is 100 VAC or less.

## 7.6.2

**FRONT PANEL TESTS**

1. Connect the HF-1000 Receiver and test equipment as illustrated in **Figure 7-2**.

**Figure 7-2. Front Panel Test Equipment Connections**

2. Set up the signal generator as follows:
 

Frequency	1.000 MHz
Output Amplitude	-10 dBm
Modulation	None (CW)
3. Turn the HF-1000 Receiver off.
4. While observing the front panel, turn the receiver on. Upon power up, verify that all LEDs and seven segment displays will light and are of uniform brilliance. Also verify that the LED in the POWER switch is lit.
5. While viewing and FREQUENCY MHz display, rotate the Receiver tuning wheel clockwise (CW) and counterclockwise (CCW). Verify that the display indicates that CW tuning increments the display and CCW tuning decrements the display.
6. Depress the TUNE LOCK button. Verify that the LED in the button lights, and that the tuning wheel is disabled.

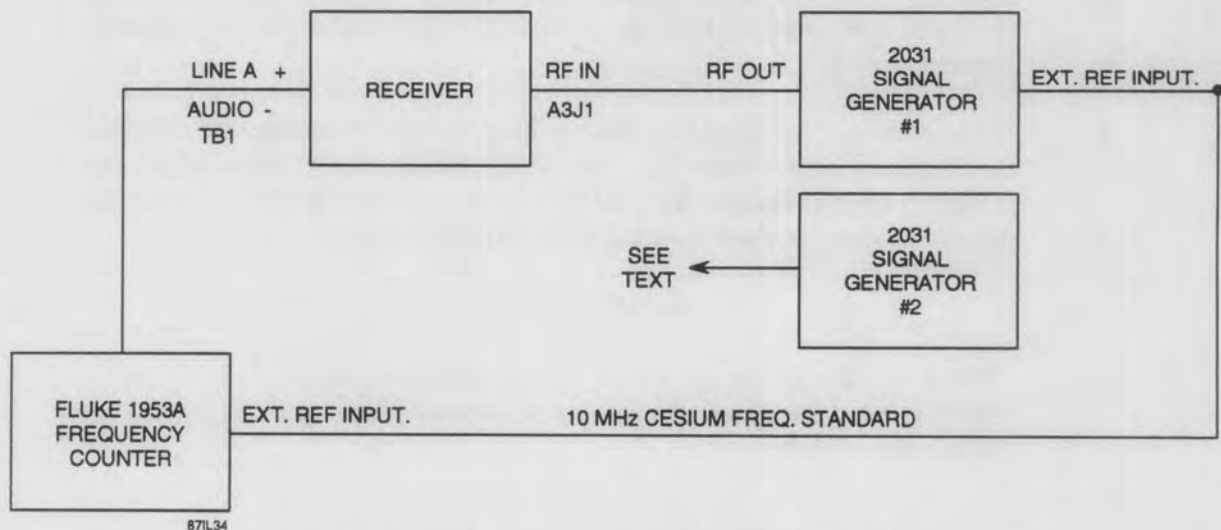
7. Depress the TUNE LOCK button again. Verify that the LED is extinguished and the tuning wheel is functional.
8. With the fast automatic gain control mode (FAST AGC) selected, tune the receiver to 1.000 MHz (the detection mode and IF bandwidth are not important). Verify the SIGNAL LEVEL meter reads between 0 and -20 dBm.
9. Referring the **Figure 3-1**, operate all of the pushbuttons and controls listed below. Verify that all of the controls function correctly. For keys that have associated function LEDs, ensure that the LED correctly indicates the status of the key.

Tuning Step Buttons  
 Numeric Keypad  
 AGC Button  
 BFO Buttons  
 BLANKER Button  
 IF BW Button  
 DETECTION MODE Button  
 SQUELCH Button  
 SPECIAL FUNCTION Button (and all special functions)  
 Auxiliary Parameters Edit Knob  
 RF INPUT Button  
 SPEAKER Button  
 MEMORY/SCAN Buttons  
 Memory/Scan Parameters Edit Knob

7.6.3

**REFERENCE FREQUENCY TIMEBASE ACCURACY**

1. Connect the HF-1000 Receiver and test equipment as illustrated in **Figure 7-3**. Apply power to the receiver and test equipment and allow a warm-up period of at least 30 minutes before proceeding with the timebase testing.



**Figure 7-3. Reference Frequency Timebase Accuracy Performance Test Equipment Connection**



2. Set Signal Generator #1 to produce a 30.0000 MHz CW signal at an output level of -80 dBm.
3. Set the HF-1000 Receiver as follows:
 

Tuned Frequency:	30.000000 MHz	FRQ 30 <Return>
Detection Mode:	CW	DET 3 <Return>
BFO Offset:	+1.00 kHz	BFO 1000 <Return>
IF Bandwidth:	6.0 kHz	BWS 4 <Return>
Gain Control:	AGC Slow	AGC 1 <Return>
Squelch:	Off	SQL 136 <Return>
4. Set the Frequency Counter for 0.1 Hz resolution.
5. Note the frequency displayed on the Frequency Counter to determine the accuracy of the receiver timebase. The displayed frequency should fall in the range between 980.0 and 1020.0 Hz.

#### NOTE

If the Frequency Counter reading noted in step 5 is outside the specified limits, perform the Reference Frequency Timebase Accuracy alignment procedure found in **paragraph 7.7.1**.

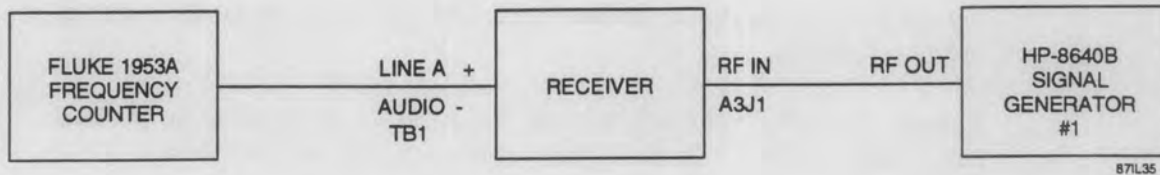
6. Set Signal Generator #2 to produce a 10.0000 MHz CW signal at an output level of 0 dBm. Connect the Signal Generator output to the EXT. REF. connector at the receiver rear panel (A3J3).
7. Note the frequency displayed on the frequency counter. This frequency should be approximately 1000 Hz, depending on the accuracy of the frequency setting in step 2.
8. While observing the frequency counter display, slowly increase and decrease the frequency of generator #2. Verify that the frequency displayed on the frequency counter changes with changes in the generator frequency, indicating that the receiver timebase is locked to the external reference.

#### NOTE

The magnitude of change on the frequency counter does not match the generator changes due to frequency scaling within the receiver.

7.6.4 FINE TUNING ACCURACY

1. Connect the HF-1000 Receiver and test equipment as illustrated in **Figure 7-4**.



**Figure 7-4. Fine Tuning Accuracy Performance Test Equipment Connection**

2. Set the signal generator to produce a 10.000000 MHz CW signal at an output level of -40 dBm.
3. Set the HF-1000 Receiver as follows:
 

Tuned Frequency:	10.000000 MHz	FRQ 10 <Return>
Detection Mode:	CW	DET 3 <Return>
BFO Offset:	+1.00 kHz	BFO 1000 <Return>
IF Bandwidth:	6.0 kHz	BWS 4 <Return>
Gain Control:	AGC Slow	AGC 1 <Return>
Squelch:	Off	SQL 136 <Return>
4. Set the frequency counter for 1.0 Hz resolution.
5. Note the frequency displayed on the frequency counter as a reference for the tuning accuracy tests. The displayed frequency is the difference between the receiver and the signal generator frequencies, plus the 1000 Hz BFO offset.
6. While observing the frequency counter display, slowly increase the receiver tuned frequency in 1 Hz, 10 Hz, 100 Hz, and 1 kHz steps. Verify that the magnitude of change on the frequency counter display tracks with the receiver tuned frequency changes, maintaining a frequency that is 1 kHz greater than the difference between the signal generator and receiver frequencies.

**NOTE**

Maintain tuned frequencies between 10.000000 and 10.003000 MHz to avoid exceeding the 6.0 kHz IF bandwidth limitations.

7.6.5 SIGNAL STRENGTH ACCURACY

1. Connect the HP-8640B Signal Generator to the RF Input of the HF-1000 Receiver (A3J1).
2. Set the signal generator to produce a 15.0000 MHz CW signal at an output level of -100 dBm.
3. Connect the digital voltmeter between the RSSI pin and ground on the rear panel connector TB1. Set the digital voltmeter function to DC Voltage, 10 V range.
4. Set the HF-1000 Receiver as follows:
 

Tuned Frequency:	15.000000 MHz	FRQ 15 <Return>
Detection Mode:	CW	DET 3 <Return>
BFO Offset:	+0.00 kHz	BFO 0 <Return>
IF Bandwidth:	6.0 kHz	BWS 4 <Return>
Gain Control:	AGC Slow	AGC 1 <Return>
Squelch:	Off	SQL 136 <Return>
5. Slowly increase the signal generator output level to 0 dBm, in 10 dB increments. At each increment, note the DC voltage displayed on the digital voltmeter and verify the receiver signal level using the "SGV?" query. On the Front Panel, observe the signal level on the signal strength meter.
6. Verify that the receiver signal strength indication remains within  $\pm 10$  dB of the signal generator output level. The DC voltage present at the RSSI output should range from approximately +1.0 V (-100 dBm) to +4.6 V (0 dBm). For each 10 dB increase of input level, the RSSI level should increase by approximately +.35 V.

7.6.6 HF-1000 SENSITIVITY PERFORMANCE TEST

1. Connect the HF-1000 Receiver and test equipment as illustrated in **Figure 7-5**.

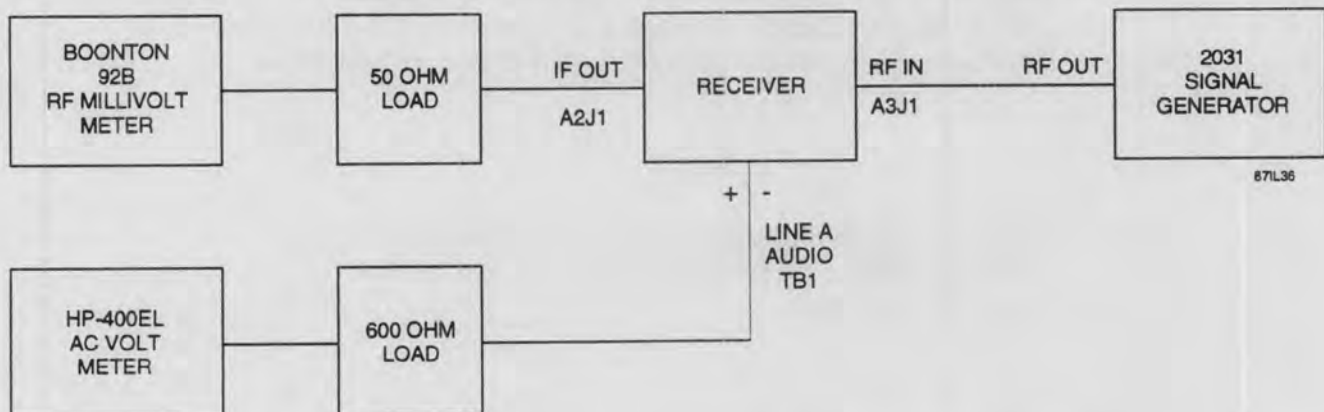


Figure 7-5. Receiver Sensitivity Performance Test Equipment Connection

2. Set the HF-1000 Receiver as follows:

Tuned Frequency:	0.500000 MHz	FRQ 5 <Return>
Detection Mode:	CW	DET 3 <Return>
BFO Offset:	+1000 Hz	BFO 1000 <Return>
IF Bandwidth:	See <b>Table 7-2</b>	
Gain Control:	Manual	AGC 0 <Return>
Gain Setting:	Mid-Range 060	RFG 60 <Return>
RF Input Path	Preamplified	RFP 3 <Return>
Squelch:	Off	SQL 136 <Return>

3. Set the receiver tuned frequency to 0.500000 MHz [FRQ .5 <Return>] and set the signal generator to produce a .5000 MHz CW output at a level of -116 dBm.
4. Set the receiver IF bandwidth and the corresponding signal generator output level to each of the settings listed in **Table 7-2**. For each of the listed settings, perform the test described in steps 5 through 8.

**Table 7-2. Sensitivity Performance Test Parameters**

IF BW (kHz)	Command	Sig. Gen Output Level (dBm)	AM Modulation	FM Mod. Frq / Dev.
0.30	BWS 1 <Return>	-116	100 Hz / 50%	100 Hz / 90 Hz
1.00	BWS 2 <Return>	-111	400 Hz / 50%	400 Hz / 400 Hz
3.20	BWS 3 <Return>	-106	400 Hz / 50%	400 Hz / 960 Hz
6.00	BWS 4 <Return>	-103	400 Hz / 50%	400 Hz / 1800 Hz

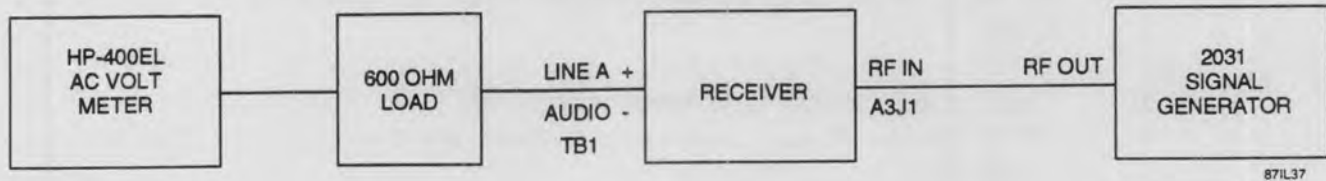
5. Set the receiver RF Gain as required to produce a -20 dBm indication on the RF millivoltmeter.
6. Note the Line A audio level indicated on the AC voltmeter as the reference level for the following CW sensitivity performance test. The typical AC voltmeter indication is  $0 \pm 3$  dBm.
7. While observing the AC voltmeter indication, turn off the signal generator RF Output.
8. Note the AC voltmeter level with the RF signal removed. Calculate the signal-to-noise ratio by subtracting this level from the reference level noted in step 6. The difference between these two levels should be a minimum of 16 dB.

9. Tune the receiver and signal generator to 5.0000 MHz, 15.0000 MHz, and 29.9000 MHz. At each frequency, repeat the test described in steps 4 through 8.
10. Set the receiver for a .50000 MHz tuned frequency [FRQ .5 <Return>], AGC Fast [AGC 2 <Return>], and select the AM Detection Mode [DET 1 <Return>]. Set the signal generator to produce a .5000 MHz AM modulated signal.
11. Set the receiver IF bandwidth, the corresponding signal generator RF output level, and the AM modulation as listed in **Table 7-2**. For each of the listed settings, perform the test described in steps 12 through 15.
12. Note the Line A audio level indicated on the AC voltmeter as the reference level for the following AM sensitivity performance test. The typical AC voltmeter indication is  $+6 \pm 3$  dBm.
13. While observing the AC voltmeter indication, turn the signal generator AM modulation off.
14. Note the AC voltmeter level with the AM modulation removed. Calculate the signal-to-noise ratio by subtracting this level from the reference level noted in step 12. The difference between these two levels should be a minimum of 10 dB.
15. Tune the receiver and signal generator to 5.0000 MHz, 15.0000 MHz, and 29.9000 MHz. At each frequency, repeat the test described in steps 11 through 14.
16. Set the receiver for a .50000 MHz tuned frequency [FRQ .5 <Return>], AGC Fast [AGC 2 <Return>], and select the FM Detection Mode [DET 2 <Return>]. Set the signal generator to produce a .5000 MHz FM modulated signal.
17. Set the receiver IF bandwidth, the corresponding signal generator RF output level, and the FM modulation as listed in **Table 7-2**. For each of the listed settings, perform the test described in steps 18 through 21.
18. Note the Line A audio level indicated on the AC voltmeter as the reference level for the following FM sensitivity performance test. The typical AC voltmeter indication is  $+0 \pm 3$  dBm.
19. While observing the AC voltmeter indication, turn the signal generator FM modulation off.

20. Note the AC voltmeter level with the FM modulation removed. Calculate the signal-to-noise ratio by subtracting this level from the reference level noted in step 18. The difference between these two levels should be a minimum of 17 dB.
21. Tune the receiver and signal generator to 5.0000 MHz, 15.0000 MHz, and 29.9000 MHz. At each frequency, repeat the test described in steps 17 through 20.
22. Set the receiver for a .50000 MHz tuned frequency [FRQ .5 <Return>], Manual Gain [AGC 0 <Return>], select the ISB Detection Mode [DET 6 <Return>] and select the 3.2 kHz IF bandwidth [BWS 3 <Return>]. Set the signal generator to produce a .5010 MHz CW output signal, at a level of -113 dBm.
23. Set the receiver RF Gain as required to produce a -20 dBm indication on the RF millivoltmeter.
24. Note the Line A audio level indicated on the AC voltmeter as the reference level for the following SSB sensitivity performance test. The typical AC voltmeter indication is  $+0 \pm 3$  dBm.
25. While observing the AC voltmeter indication, turn off the signal generator RF Output.
26. Note the AC voltmeter level with the RF signal removed. Calculate the signal-to-noise ratio by subtracting this level from the reference level noted in step 24. The difference between these two levels should be a minimum of 16 dB.
27. Temporarily remove the AC voltmeter and 600-ohm load from the Line A output of TB1 and connect them across the + and - pins of the Line B output. Tune the signal generator to 1.0000 kHz below the receiver tuned frequency and repeat steps 23 through 26 to verify the lower sideband of the ISB outputs.
28. Reconnect the AC voltmeter and 600-ohm load across the Line A output pins of TB1.
29. Tune the receiver and signal generator to 5.0000 MHz, 15.0000 MHz, and 29.9000 MHz. In each case, set the signal generator frequency for 1.000 kHz above the receiver tuned frequency. At each frequency, repeat the test described in steps 23 through 27.

7.6.7 **AUDIO DISTORTION PERFORMANCE TEST**

1. Connect the HF-1000 Receiver and test equipment as illustrated in **Figure 7-6**.



**Figure 7-6. Audio Distortion Performance Test Equipment Connection**

2. Set the signal generator to produce a 15.0000 MHz AM modulated signal at an output level of -50 dBm. Set the AM modulation to 400 Hz, at 30 %.
3. Preset the distortion analyzer as follows:

Mode:	Manual
Frequency Range:	X10
Function:	Voltmeter
Meter Range:	1 Volt

4. Set the HF-1000 Receiver as follows:

Tuned Frequency:	15.000000 MHz	FRQ 15 <Return>
Detection Mode:	AM	DET 1 <Return>
IF Bandwidth:	6.0 kHz	BWS 4 <Return>
Gain Mode:	AGC Slow	AGC 1 <Return>
Gain Setting:	Mid-Range 060	RFG 60 <Return>
RF Input Path	Normal	RFP 1 <Return>
Squelch:	Off	SQL 136 <Return>

5. Verify that the detected audio level is 0 ±3 dBm, as indicated on the analyzer voltmeter.

**NOTE**

Due to a +10 dB offset on the distortion analyzer voltmeter, the +10 dB scale is used for a 0 dBm reading.

6. Reset the distortion analyzer meter range to the 3 volt scale and increase the signal generator modulation level to 50%.
7. Set the distortion analyzer function control and meter range to the SET LEVEL positions. Adjust the distortion analyzer sensitivity control for a 100% indication on the meter (an indication of "1" on the 0-1 scale).

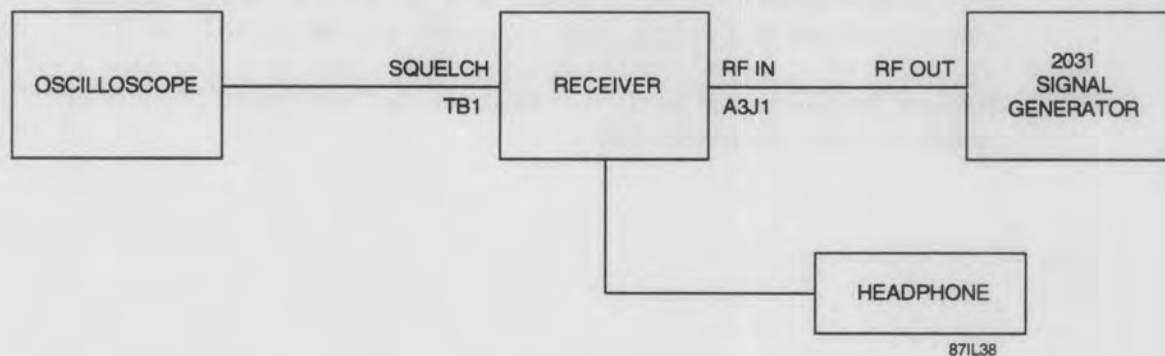
8. Set the distortion analyzer function control to the Distortion position. Slowly adjust the distortion analyzer Frequency control for a minimum indication on the meter. Reset the meter range as required for the best meter resolution. Verify that the total harmonic distortion measured does not exceed 5%.
9. Set the receiver detection mode to ISB [DET 6 <Return>] and the IF bandwidth to 3.2 kHz [BWS 3 <Return>].
10. Reset the distortion analyzer as follows:
 

Mode:	Manual
Frequency Range:	X100
Function:	Voltmeter
Meter Range:	3 Volt
11. Reset the signal generator to produce a 15.0010 MHz CW signal at a -50 dBm output level (modulation off, frequency 1.0 kHz greater than the receiver tuned frequency).
12. Verify that the detected audio level indicated on the distortion analyzer voltmeter is  $0 \pm 3$  dBm.
13. Set the distortion analyzer function control and meter range to the SET LEVEL positions. Adjust the distortion analyzer sensitivity control for a 100% indication on the meter.
14. Set the distortion analyzer function control to the Distortion position. Slowly adjust the distortion analyzer Frequency control for a minimum indication on the meter. Reset the meter range as required for the best meter resolution. Verify that the total harmonic distortion measured does not exceed 5%.

7.6.8

**SQUELCH/MUTE PERFORMANCE TEST**

1. Connect the HF-1000 Receiver and test equipment as illustrated in **Figure 7-7**.



**Figure 7-7. Squelch/Mute Performance Test Equipment Connection**

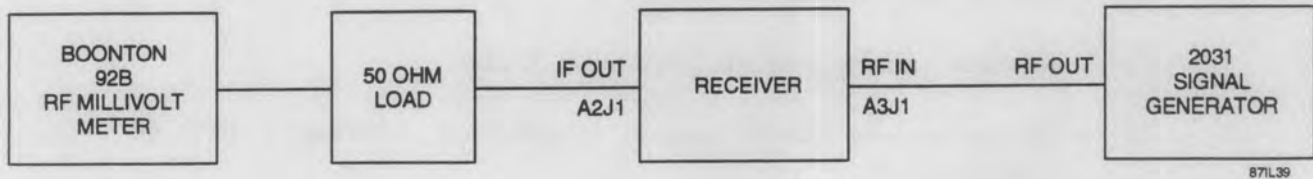


2. Set the HF-1000 Receiver as follows:

Tuned Frequency:	15.000000 MHz	FRQ 15 <Return>
Detection Mode:	AM	DET 1 <Return>
IF Bandwidth:	6.0 kHz	BWS 4 <Return>
Gain Mode:	AGC Fast	AGC 2 <Return>
RF Input Path	Normal	RFP 1 <Return>
Squelch:	-120	SQL 120 <Return>
3. Set the signal generator to produce a 15.0000 MHz CW output at a level of -130 dBm.
4. Observe that a steady logic "1" level (+5V) is present at the Squelch terminal of the rear panel connector TB1, as indicated on the oscilloscope.
5. While observing the oscilloscope trace, slowly increase the signal generator output level until the trace indicates a logic "0" (0V) level. Note the signal generator output level at which the squelch output switches. Verify that the signal generator output level is within  $\pm 10$  dB of the receiver squelch setting.
6. Increase the receiver squelch threshold in 10 dB increments, up to 0 dBm. At each increment, increase the signal generator output level until the oscilloscope displays a logic "0" level, indicating that the squelch has turned off. Note the signal generator output level at each switchpoint. Verify that at each level tested, the signal generator output level is within  $\pm 10$  dB of the receiver squelch setting.
7. Set the squelch to -100 dBm [SQL 100 <Return>] and set the signal generator to produce a 15.0000 MHz AM modulated output, at a level of -40 dBm. Set the modulation to 400 Hz, 50%.
8. Observe that a clear 400 Hz tone is present in the headphones, and the oscilloscope indicates a logic "0" at the squelch output terminal.
9. While monitoring the headphone audio and the oscilloscope display, connect a short jumper between the MUTE line of TB1 and ground. Observe that the audio cuts off and after a slight delay, the squelch line switches to Logic "1".
10. Remove the jumper and verify that the audio, and the squelch logic level return to the state observed in step 8.

7.6.9 RECONSTRUCTED IF OUTPUT PERFORMANCE TEST

1. Connect the HF-1000 Receiver and test equipment as illustrated in **Figure 7-8**.



**Figure 7-8. Reconstructed IF Output Performance Test Equipment Connection**

2. Set the signal generator to produce a 15.0000 MHz CW output at a level of -100 dBm.
3. Set the RF millivoltmeter to the -20 dBm range.
4. Set the HF-1000 Receiver as follows:
 

Tuned Frequency:	15.000000 MHz	FRQ 15 <Return>
Detection Mode:	AM	DET 1 <Return>
IF Bandwidth:	6.0 kHz	BWS 4 <Return>
Gain Control:	AGC Slow	AGC 1 <Return>
RF Input Path	Normal	RFP 1 <Return>
Squelch:	Off	SQL 136 <Return>
5. Note the IF Output signal level, as indicated on the RF millivoltmeter. Verify that the output level is  $-20 \pm 3$  dBm (-23 to -17 dBm).
6. While observing the signal level on the RF millivoltmeter, increase the signal generator output level, in 10 dB increments, to an output level of 0 dBm. Verify that throughout the 100 dB change in the RF input signal level, the IF output level  $-20 \pm 3$  dBm is maintained.
7. Decrease the signal generator output level to -115 dBm.
8. Set the receiver to the Manual Gain mode [ AGC 0 <Return> ] and set the manual gain to maximum [ RFG 127 <Return> ].
9. Adjust the signal generator output level to produce a -20 dBm reference level, as displayed on the RF millivoltmeter (Typical signal generator output level of -112 dBm).
10. Set the receiver manual gain to minimum [ RFG 0 <Return> ].

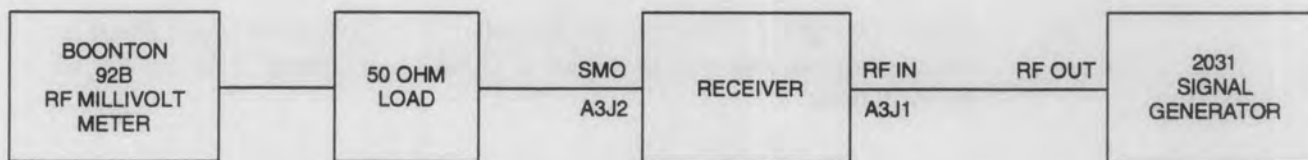
11. Increase the signal generator output level to +12 dBm and note the signal level indicated on the RF millivoltmeter. Verify that the RF millivoltmeter indication is less than the -20 dBm reference set in step 9, indicating greater than 100 dB of manual gain control.
12. Adjust the signal generator output level to -55 dBm.
13. Set the receiver manual gain to approximately mid-range [ RFG 60 <Return>].
14. Increase the signal generator output level until a -20 dBm signal level reference is indicated on the RF millivoltmeter. Typically a signal generator output level of approximately -50 dBm is required.
15. While observing the RF millivoltmeter, slowly increase the signal generator frequency until the RF millivoltmeter indication decreases by 3 dB from the reference set in step 14. Note the signal generator frequency at this point.
16. Slowly decrease the signal generator frequency past the 15.0000 MHz tuned frequency and continue until the RF millivoltmeter again displays a 3 dB decrease from the reference level set in step 14. Note the signal generator frequency at this point.
17. Determine the 3 dB bandwidth of the reconstructed IF output by subtracting the value obtained in step 16 from the value obtained in step 15. The calculated bandwidth should be within  $\pm 10\%$  of the selected IF bandwidth, as indicated in **Table 7-3**.
18. Set the HF-1000 Receiver to each of the IF bandwidths listed in **Table 7-3**, and repeat steps 14 through 17 for each selection.

**Table 7-3. Selected IF Bandwidth Frequency Ranges**

IF BW (kHz)	Control Command	BW Min. (kHz)	BW Max. (kHz)
0.30	BWS 1 <Return>	0.270	0.330
1.00	BWS 2 <Return>	0.900	1.100
3.20	BWS 3 <Return>	2.880	3.502
6.00	BWS 4 <Return>	5.400	6.600

7.6.10 **RF/IF SIGNAL PATH PERFORMANCE TEST**

1. Connect the HF-1000 Receiver and test equipment as illustrated in **Figure 7-9**.



871L40

**Figure 7-9. RF/IF Signal Path Performance Test Equipment Connection**

2. Set the signal generator to produce a 10.000000 MHz CW output at a level of -70 dBm.
3. Set the RF millivoltmeter to the -30 dBm range.
4. Set the HF-1000 Receiver as follows:
 

Tuned Frequency:	10.000000 MHz	FRQ 10 <Return>
Detection Mode:	AM	DET 1 <Return>
IF Bandwidth:	6.0 kHz	BWS 4 <Return>
Gain Control:	Manual Gain	AGC 0 <Return>
Gain Setting	Mid Range 060	RFG 60 <Return>
RF Input Path	Normal	RFP 1 <Return>
Squelch:	Off	SQL 136 <Return>
5. Adjust the signal generator output level as required to produce a -30 dBm reference level, as indicated on the RF millivoltmeter.
6. Determine the RF Assembly gain by comparing the signal generator output level with the SMO signal level indicated on the RF millivoltmeter. Typically, the signal gain ranges between 25 and 35 dB.
7. While observing the signal level on the RF millivoltmeter, slowly increase the signal generator frequency until a decrease of 3 dB, from the reference set in step 5, is observed. Note the signal generator output frequency at this point.
8. Slowly decrease the signal generator frequency past the 10.0000 MHz tuned frequency and continue until the RF millivoltmeter again displays a 3dB decrease in signal level from the reference set in step 5. Note the signal generator output frequency at this point.

9. Determine the 3 dB bandwidth of the RF signal path by subtracting the frequency value obtained in step 8 from the value obtained in step 7. The calculated bandwidth should be at least 0.0300 MHz (30.0 kHz).
10. Return the signal generator output frequency to 10.000000 MHz and adjust the output level as required to obtain a -30 dBm reference level on the RF millivoltmeter.
11. Set the RF Input path of the receiver to the ATTENUATED selection. [ RFP 2 <Return> ]
12. Note the signal level indicated on the RF millivoltmeter. The signal level should decrease by  $15 \pm 3$  dB from the reference level set in step 10.
13. Set the RF millivoltmeter to the -20 dBm range and set the receiver RF Input path to the PREAMPLIFIED selection. [ RFP 3 <Return> ]
14. Note the signal level indicated on the RF millivoltmeter. The signal level should increase by  $10 \pm 3$  dB from the reference set in setup 10.

## 7.7

**ALIGNMENT PROCEDURES**

The HF-1000 has been designed to operate for extended periods without the need for module alignment. However, it may become necessary to adjust the unit's internal Temperature-Controlled Voltage-Controlled Oscillator (TCVCXO) if the Reference Frequency Timebase Accuracy performance test falls outside the specified limits (see **paragraph 7.6.3**).

**WARNING**

This equipment utilizes voltages which are potentially dangerous and may be fatal if contacted. Whenever a problem is suspected, repair and maintenance of the equipment should be performed by qualified maintenance personnel only. This equipment contains no user serviceable parts.

### 7.7.1 **REFERENCE FREQUENCY TIMEBASE ACCURACY ALIGNMENT PROCEDURE**

The following steps provide the alignment procedure necessary for adjusting the unit's internal TCVCXO when an out-of-tolerance condition has been determined.

1. Connect the Receiver and test equipment as described in **paragraph 7.6.3**, Reference Frequency Timebase Accuracy performance test. Apply power to the receiver and test equipment and allow a warm-up period of at least 30 minutes before proceeding with the timebase alignment procedure.
2. Perform the Reference Frequency Timebase Accuracy performance procedure, step 1 through step 5 only.
3. With the receiver and test equipment power ON, remove the top cover of the receiver.
4. Locate module A3, RF Tuner Assembly (Type 797006-6), and locate R59 (a 10 kohm variable resistor).
5. While monitoring the Frequency Counter, adjust R59 until the displayed frequency is within the specified limits provided in **paragraph 7.6.3**, step 5.
6. Install the receiver's top cover, and repeat the timebase performance test (**paragraph 7.6.3**).

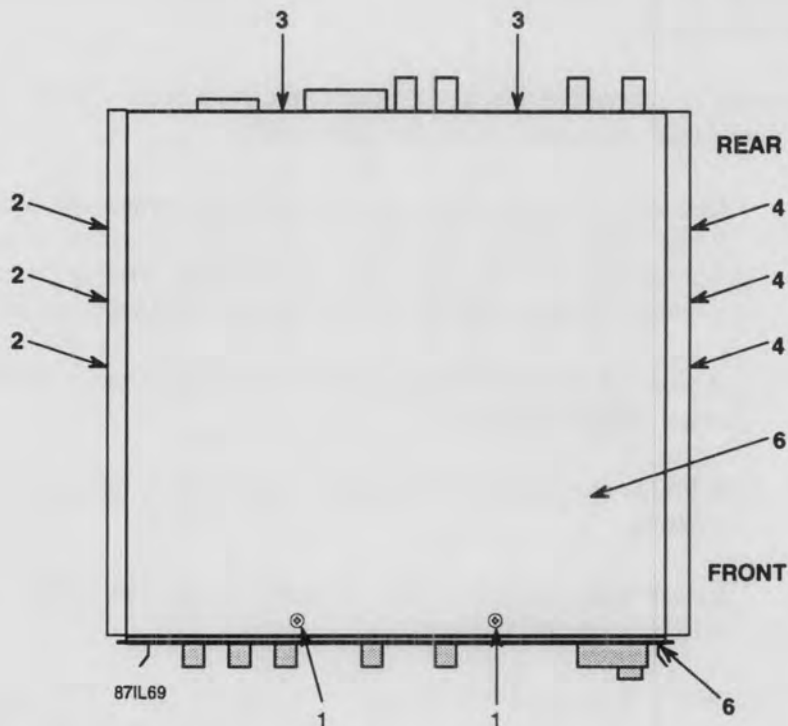
### 7.8 **CORRECTIVE MAINTENANCE PROCEDURES**

Procedures for removal and replacement of faulty subassemblies and selected components are documented in the following paragraphs. Contact your supervisor or Watkins-Johnson Company prior to breaking any factory applied inspection seals on the unit to avoid the possibility of voiding the warranty. The normal repair procedure while the unit is under warranty is to return the entire unit to the factory for warranty repair.

#### 7.8.1 **REMOVING THE RECEIVER TOP COVER**

Refer to **Figure 7-10**. The following procedures are used to remove the top cover from the receiver.

1. Place the receiver in its normal upright position and remove two screws (1) from the top of the receiver, two screws (3) from the rear panel of the receiver, three screws (2) from the left side of the receiver, and three screws (4) from the right side of the receiver that secure the top cover (5) to the receiver (6).
2. Lift the top cover (5) from the receiver (6).



**Figure 7-10. Removing/Replacing Receiver Top Cover**

7.8.2

**REPLACING THE RECEIVER TOP COVER**

Refer to **Figure 7-10**. The following procedures are used to replace the top cover on the receiver.

1. Place the top cover (5) on the top of the receiver(6).
2. Replace the two screws (1) in the top of the receiver, two screws (3) in the rear panel of the receiver, three screws (2) in the left side of the receiver, and three screws (4) in the right side of the receiver to secure the top cover (5) to the receiver (6).

7.8.3

**FRONT PANEL ASSEMBLY (A1) REMOVAL PROCEDURES**

Refer to **Figure 7-11** and **Figure 7-12**.

1. Remove plug A1A1P1 (2) from A2J7 on the Digital Control PC Assembly (1).
2. Remove plug PS1P1 (4) from A1A1J1 on the Front Panel PC Assembly (3).

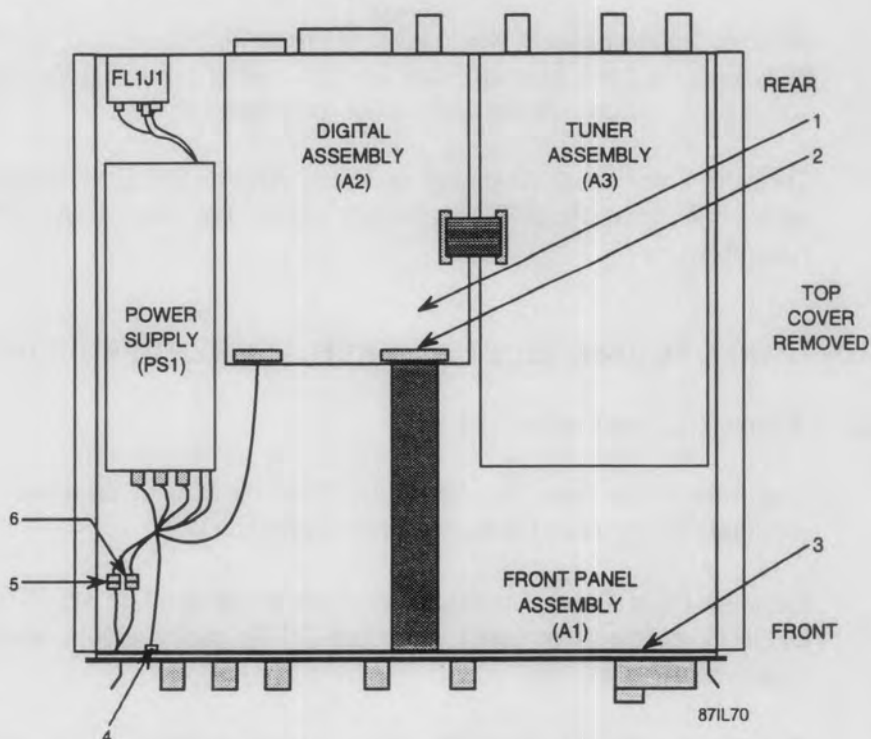
3. Remove in-line plug S1P1 (5) from PS1J1. (**Note:** Tag or mark plug for identification purposes during replace procedures.)
4. Remove in-line plug W1P1 (6) from S1J1. (**Note:** Tag or mark plug for identification purposes during replace procedures.)
5. Remove four screws (7) from the receiver front panel (8).

7.8.4

**FRONT PANEL ASSEMBLY (A1) REPLACEMENT PROCEDURES**

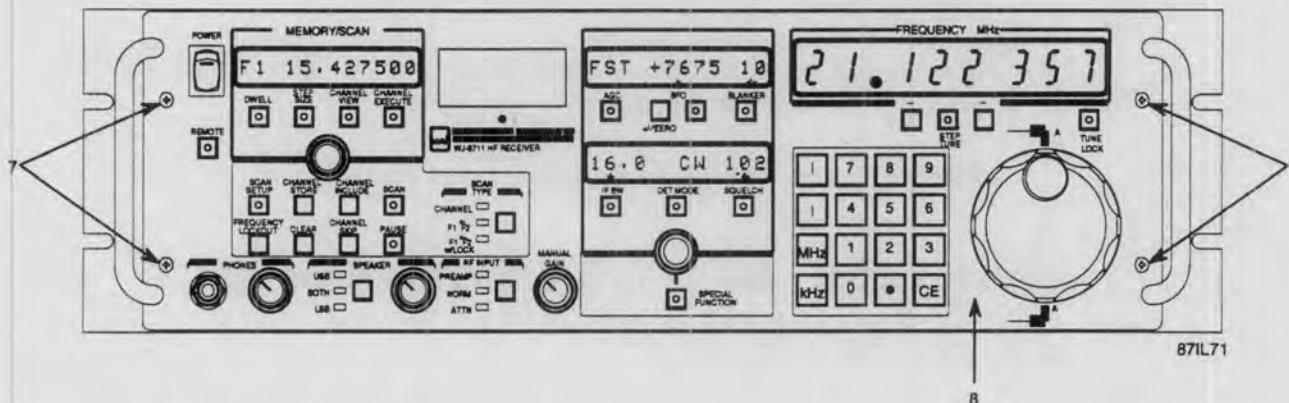
Refer to **Figure 7-11** and **Figure 7-12**.

1. Attach the Front Panel Assembly (8) to the receiver chassis using four screws (7).
2. Connect plug A1A1P1 (2) to connector A2J7 on the Digital Control PC Assembly (2).
3. Connect plug PS1P1 (4) to A1A1J1 on the Front Panel PC Assembly (3).
4. Connect in-line plug S1P1 (5) to PS1J1.
5. Connect in-line plug W1P1 (6) to S1J1.



**Figure 7-11. Front Panel Assembly (A1) Remove and Replace Procedures (Part 1)**





**Figure 7-12. Front Panel Assembly (A1) Remove and Replace Procedures (Part 2)**

**7.8.5 FRONT PANEL PC ASSEMBLY (A1A1) REMOVAL PROCEDURES**

Refer to **Figure 7-13** and **Figure 7-14**.

1. Remove five small front panel knobs (3) from the Front Panel Assembly (2) by pulling each knob forward from the shaft.
2. Remove the large tuning wheel knob (1) from the Front Panel Assembly (2) by pulling the knob forward from the shaft. After removing the large tuning wheel knob, remove the nut and washer from the shaft.
3. Turn the Front Panel Assembly over and remove the eight screws (4) that secure the Front Panel PC Assembly (5) to the rear of the Front Panel Assembly (6).

**7.8.6 FRONT PANEL PC ASSEMBLY (A1A1) REPLACEMENT PROCEDURES**

Refer to **Figure 7-13** and **Figure 7-14**.

1. Attach the Front Panel PC Assembly (5) to the rear of the Front Panel PC Assembly (6) by using the eight screws (4) provided.
2. Turn the Front Panel Assembly over and attach the five small front panel knobs (3) to the front panel Assembly (2) by pushing each knob onto its respect shaft.
3. Place the washer and nut on the shaft of the large tuning wheel knob (1) and tighten the nut securely on the shaft. Attach the large tuning wheel knob (1) to the Front Panel Assembly (2) by pushing it securely onto its shaft.

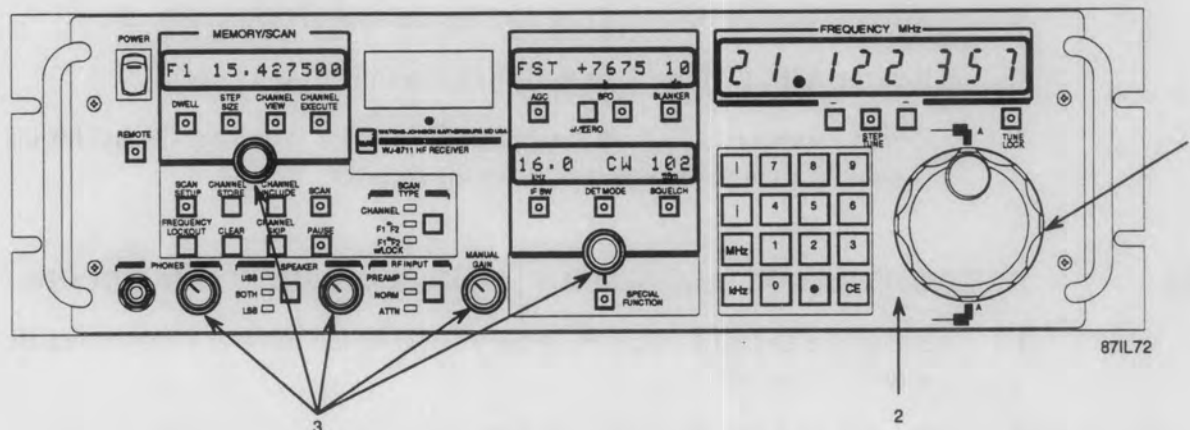


Figure 7-13. Front Panel PC Assembly (A1A1) Remove and Replace Procedures (Part 1)

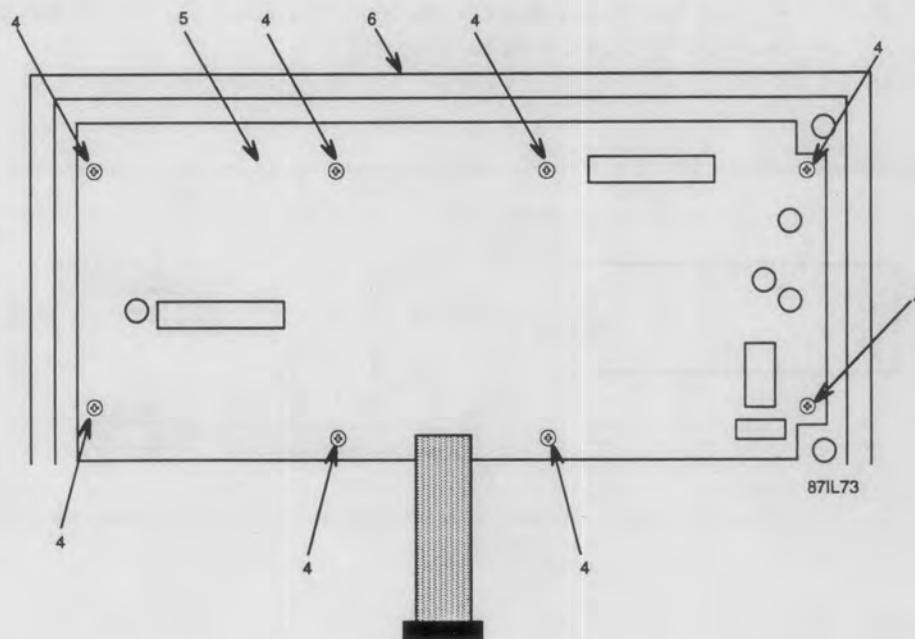


Figure 7-14. Front Panel PC Assembly (A1A1) Remove and Replace Procedures (Part 2)

7.8.7

**DIGITAL CONTROL PC ASSEMBLY (A2) REMOVAL PROCEDURES**

Refer to **Figure 7-15** and **Figure 7-16**.

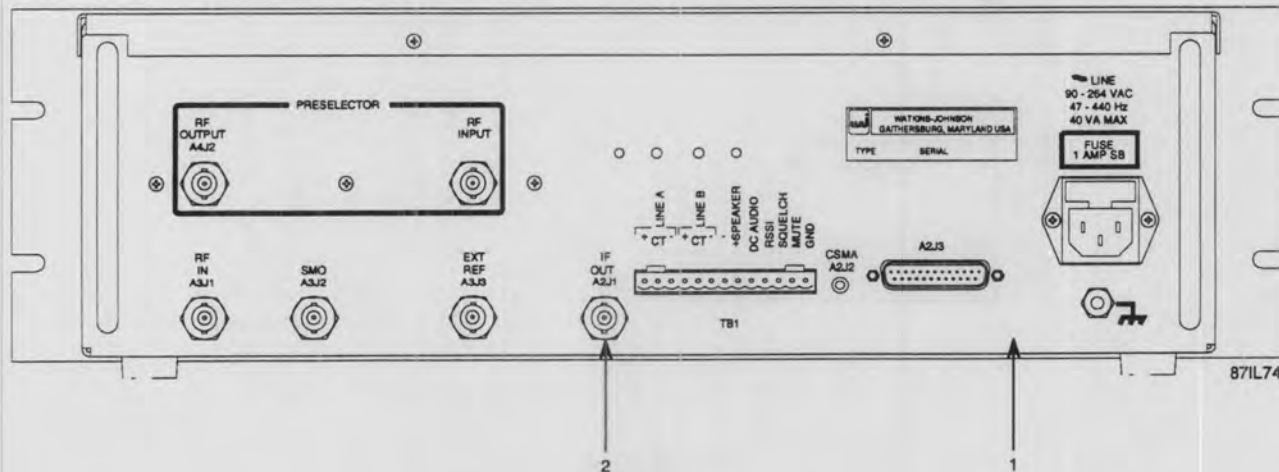
1. Remove the nut and washer from connector A2J1 (2) on the rear panel of the receiver (1).
2. Remove PS1P2 (6) from J5 on the Digital Control PC Assembly (3).

3. Remove A1A1P1 (4) from J7 on the Digital Control PC Assembly (3).
4. Remove A3P1 (7) from J4 on the Digital Control PC Assembly (3).
5. Remove six screws (5) from the Digital Control PC Assembly (3) and lift the Digital PC Control PC Assembly from the receiver.

7.8.8

**DIGITAL CONTROL PC ASSEMBLY (A2) REPLACEMENT PROCEDURES**

1. Secure the Digital Control PC Assembly (3) to the receiver by attaching six screws (5) securely.
2. Connect A1A1P1 (4) to J7 on the Digital Control PC Assembly (3).
3. Connect PS1P2 (6) to J5 on the Digital Control PC Assembly (3).
4. Connect A3P1 (7) to J4 on the Digital Control PC Assembly (3).
5. Replace the washer and nut on connector A2J1 (2) on the rear panel of the receiver (1). Tighten the nut securely.



**Figure 7-15. Digital Control PC Assembly (A2) Remove and Replace Procedures (Part 1)**

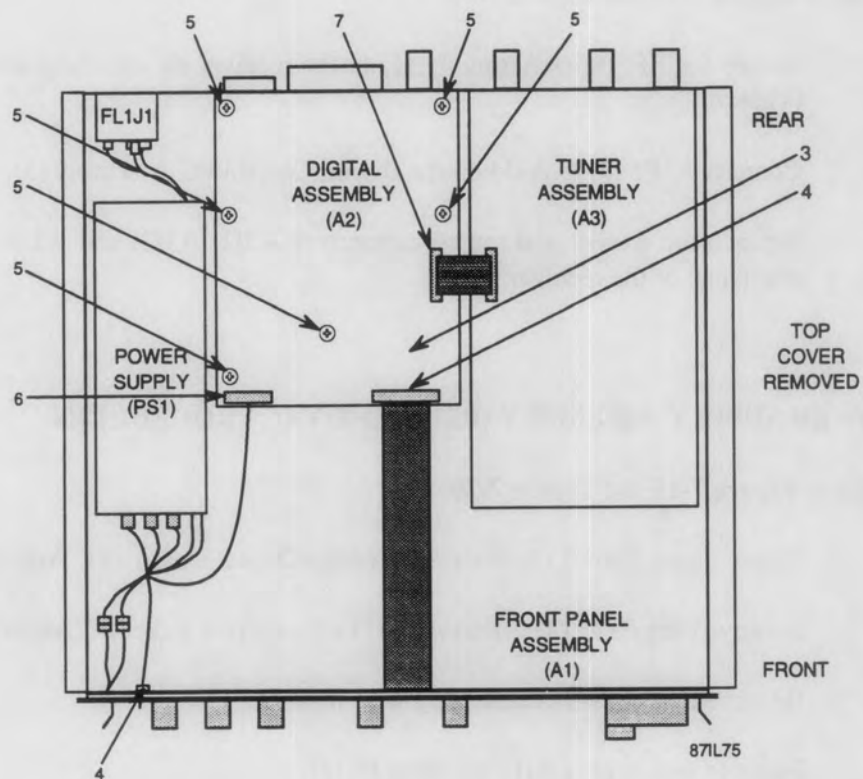


Figure 7-16. Digital Control PC Assembly (A2) Remove and Replace Procedures (Part 2)

7.8.9

**RF TUNER ASSEMBLY (A3) REMOVAL PROCEDURES**

Refer to **Figure 7-17** and **Figure 7-18**.

1. Remove the nut and washer from connectors A3J1, A3J2, and A3J3 (2) on the rear panel of the receiver (1).
2. Remove A3P1 (3) from A2J4 on the Digital Control PC Assembly (5).
3. Remove seven screws (4) from the RF Tuner Assembly (5) and lift the RF Tuner Assembly from the receiver.

7.8.10 **RF TUNER ASSEMBLY (A3) REPLACEMENT PROCEDURES**

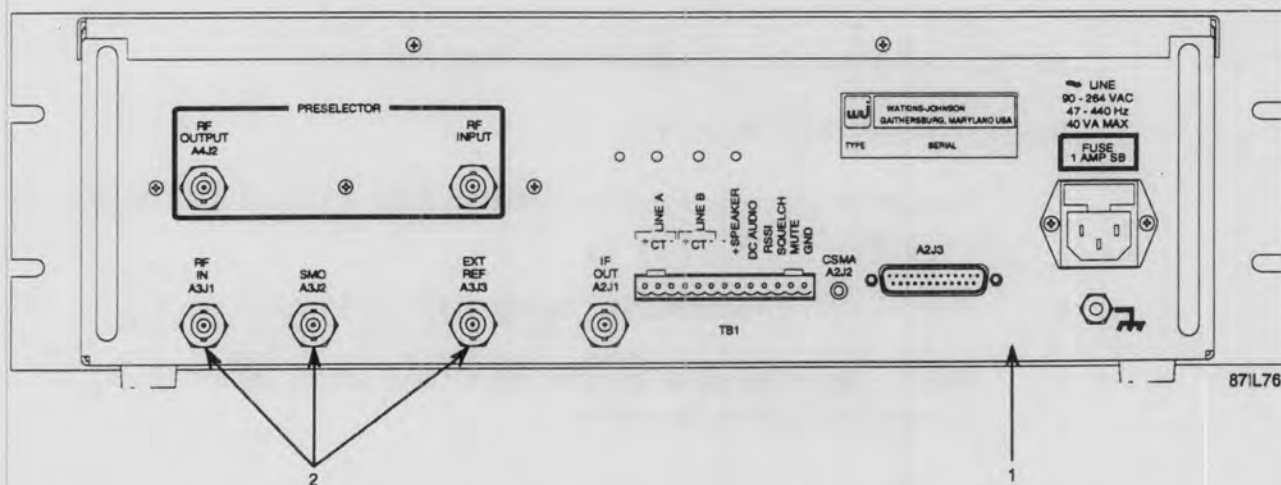
Refer to **Figure 7-17** and **Figure 7-18**.

1. Secure the RF Tuner Assembly (5) to the receiver by attaching seven screws (4) securely.
2. Connect A3P1 (3) to A2J4 on the Digital Control PC Assembly (5).
3. Replace the washer and nut on connectors A3J1, A3J2, and A3J3 (2) on the rear panel of the receiver (1).

7.8.11 **POWER SUPPLY ASSEMBLY (PS1) REMOVAL PROCEDURES**

Refer to **Figure 7-19** and **Figure 7-20**.

1. Remove plug PS1P2 (5) from A2J5 on the Digital Control PC Assembly (1).
2. Remove plug PS1P1 (2) from A1A1J1 on the Front Panel PC Assembly (3).
3. Remove fuse (6) with connecting wire from FL1J1.
4. Remove in-line plug S1P1 (4) from PS1J1.
5. Remove four screws (8) from the left side of the receiver (7) and lift the Power Supply Assembly from the receiver.



**Figure 7-17. RF Tuner Assembly (A3) Remove and Replace Procedures (Part 1)**

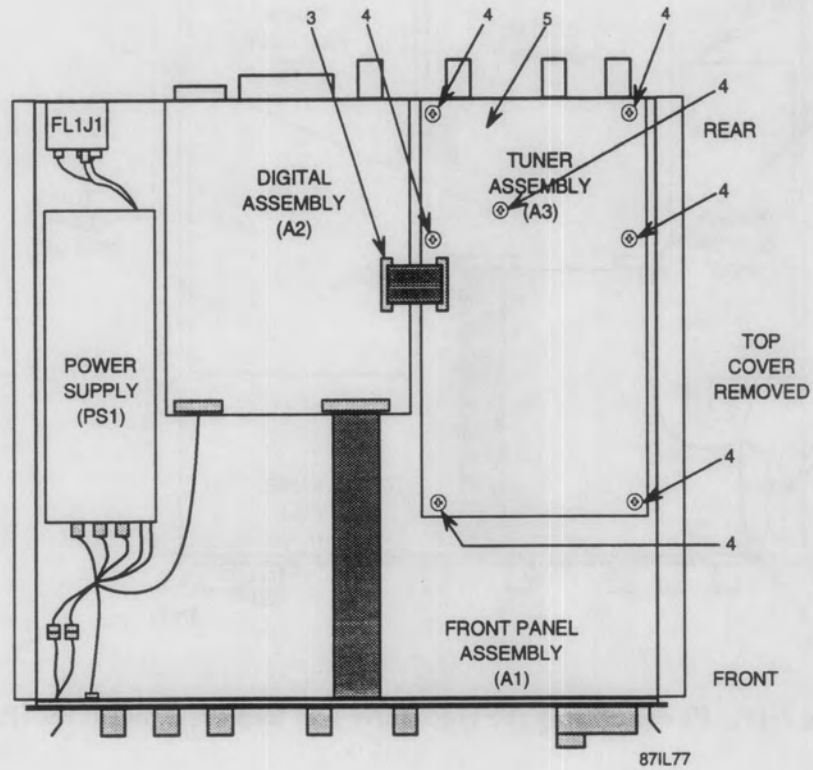


Figure 7-18. RF Tuner Assembly (A3) Remove and Replace Procedures (Part 2)

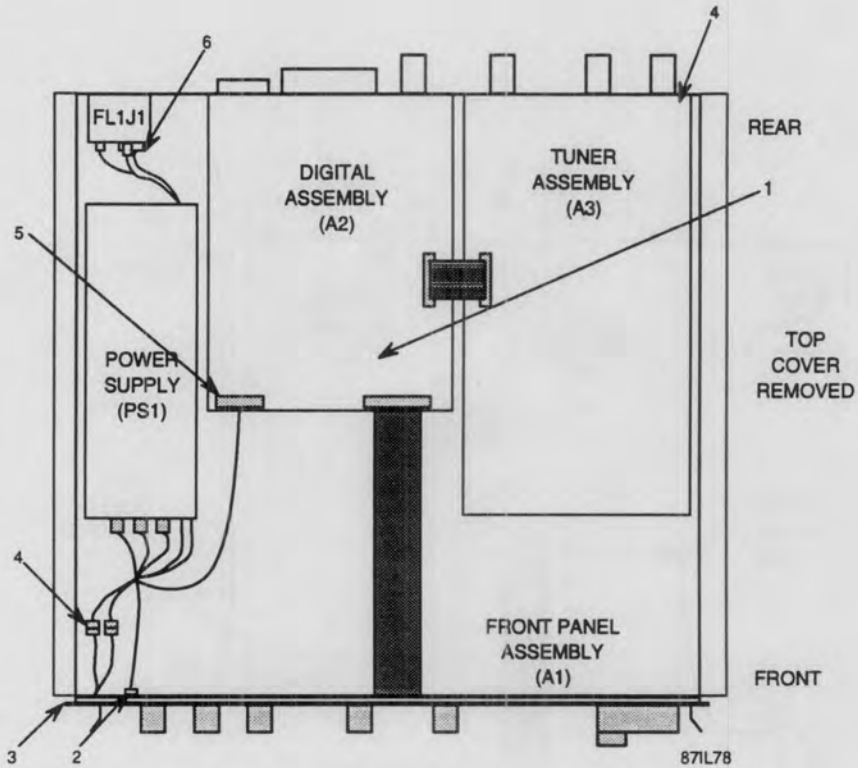


Figure 7-19. Power Supply (PS1) Remove and Replace Procedures (Part 1)

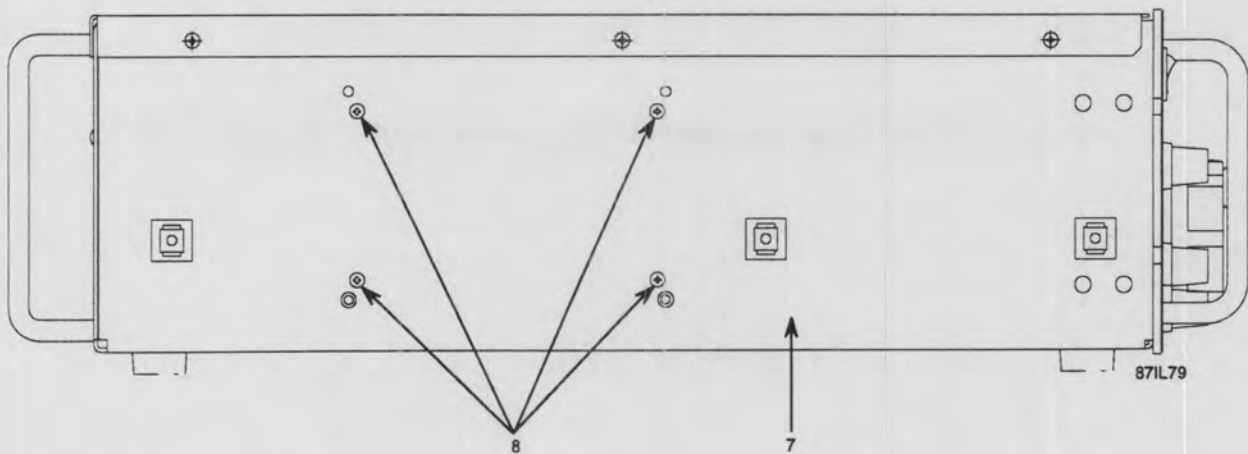


Figure 7-20. Power Supply (PS1) Remove and Replace Procedures (Part 2)

7.8.12      **POWER SUPPLY ASSEMBLY (PS1) REPLACEMENT PROCEDURES**

Refer to **Figure 7-19** and **Figure 7-20**.

1.      Secure the Power Supply Assembly to the receiver by attaching four screws (8) to the left side of the receiver (7) securely.
2.      Connect plug PS1P1 to A1A1J1 (2) on the Front Panel Assembly (3).
3.      Connect plug PS1P12 to A2J5 (5) on the Digital Control PC Assembly (1).
4.      Connect fuse (6) and connecting wire to FL1P1.
5.      Connect in-line plug S1P1 to PS1J1 (4).

7.8.13      **FILTER/POWER (FL1J1) REMOVAL PROCEDURES**

Refer to **Figure 7-21** and **Figure 7-22**.

1.      Remove two wires and one fuse from the Filter/Power module (1). (**Note:** Tag or mark each wire for identification purposes during replace procedures.)
2.      Remove two screws (2) from the rear of the receiver (3) and lift the Filter/Power module from the receiver.

7.8.14      **FILTER/POWER (FL1J1) REPLACEMENT PROCEDURES**

Refer to **Figure 7-21** and **Figure 7-22**.

1.      Secure the Filter/Power module to the receiver (3) by securely attaching two screws (2).
2.      Connect one fuse and two wires to the Filter/Power module (1).



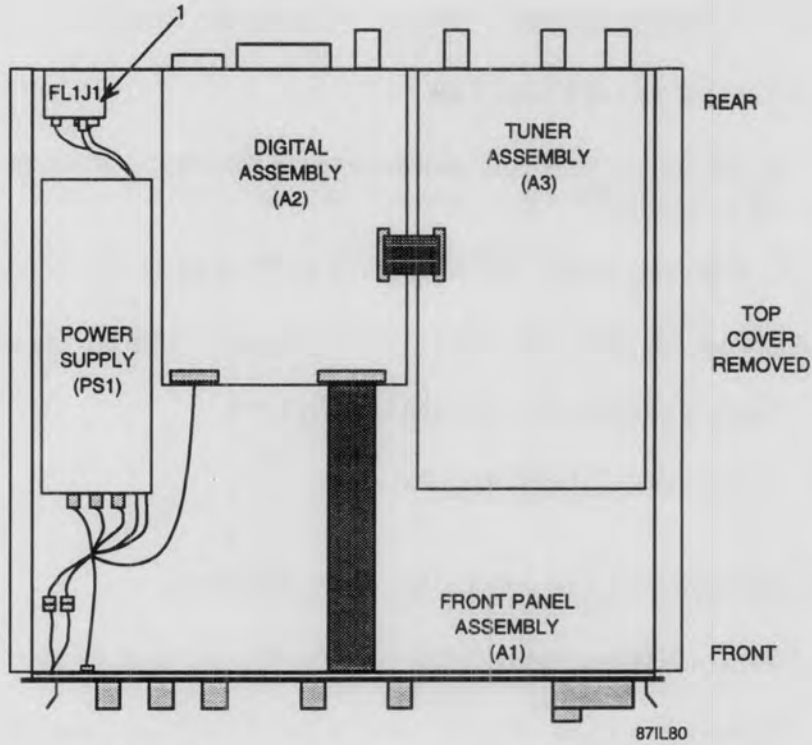


Figure 7-21. Filter/Power (FL1J1) Removal and Replacement Procedures (Part 1)

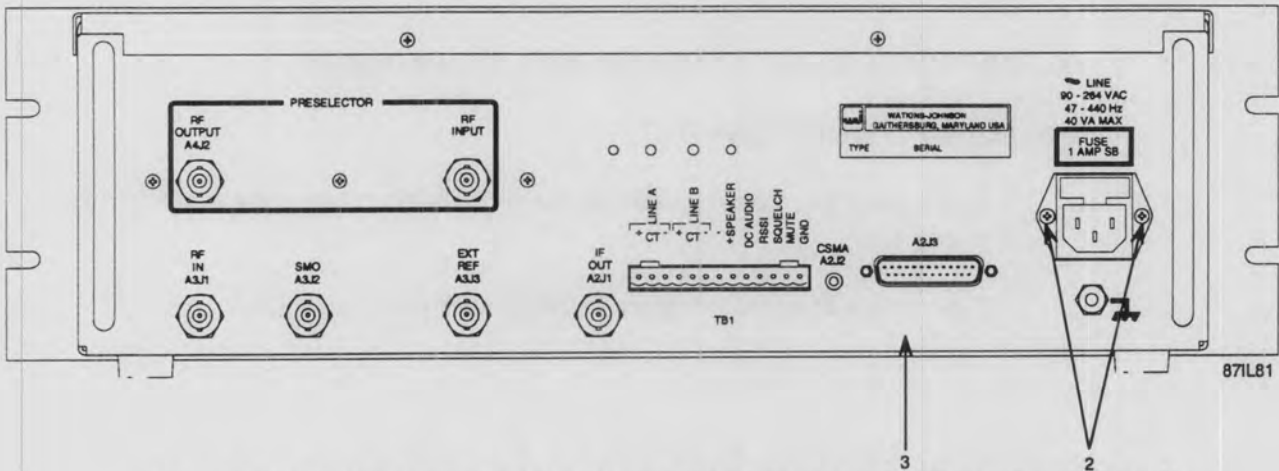
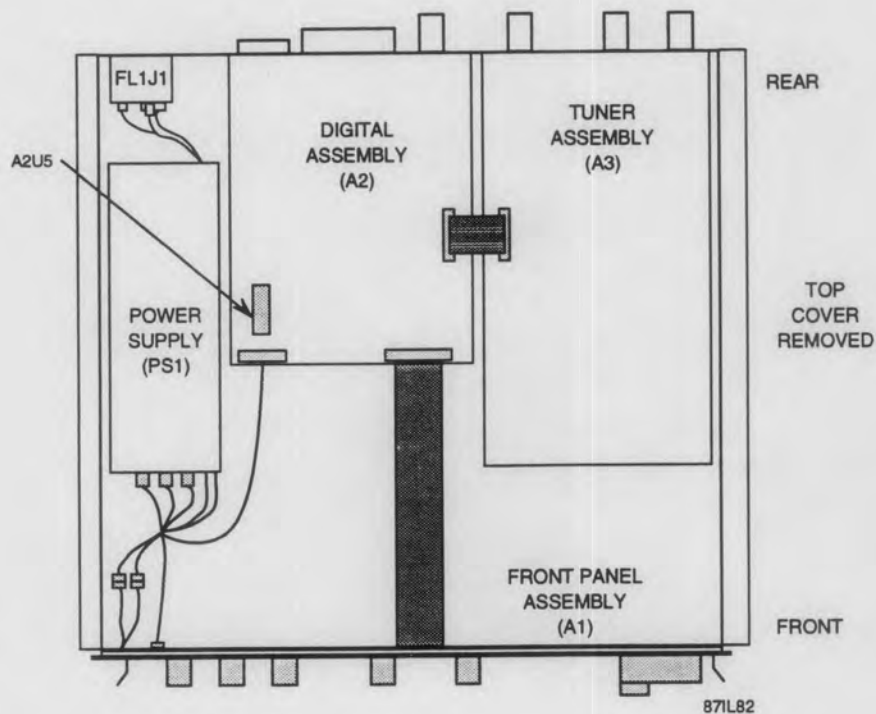


Figure 7-22. Filter/Power (FL1J1) Removal and Replacement Procedures (Part 2)

7.8.15 **RAM/BATTERY (A2U5) REMOVAL/REPLACEMENT PROCEDURES**

Component A2U5 is a plug-in chip that furnishes battery power (V Batt) for the Digital Control PC Assembly (A2). U5 may require replacement as a result of failure of the battery, failure of the other functions of the chip, or as a result of preventive maintenance activities designed to periodically replace the battery.

Refer to **Figure 7-23** for the approximate location of U5 on the Digital Control PC Assembly. If your receiver contains a Digital Expansion Assembly (Options) Board A2A1, the Digital Expansion Assembly (Options) A2A1 must be removed for access to the A2U5 component. (**Note:** Observe proper Electro Static Discharge (ESD) procedures when removing and replacing A2U5.)



**Figure 7-23. RAM/BATTERY (U5) Removal and Replacement Procedures**

**SECTION VIII**  
**REPLACEMENT PARTS LIST**

**SECTION VIII**

**REPLACEMENT PARTS LIST**

**8.1 UNIT NUMBERING METHOD**

The method of numbering used throughout the unit is assigning reference designations (electrical symbol numbers) to identify: assemblies, subassemblies, modules within a subassembly, and discrete components. An example of the unit numbering method used is as follows:

<u>Subassembly Designation A1</u>	<u>R1 Class and No. of Item</u>
Identify from right to left as:	First (1) resistor (R) of first (1) subassembly (A)

On the main chassis schematic, components which are an integral part of the main chassis have no subassembly designations.

**8.2 REFERENCE DESIGNATION PREFIX**

The use of partial reference designations are used on the equipment and on the manual illustrations. This partial reference designation consists of the component type letter(s) and the identifying component number. The complete reference designation may be obtained by placing the proper prefix before the partial reference designation. Reference designation prefixes are included on the drawings and illustrations in the figure titles (in parenthesis).

**8.3 LIST OF MANUFACTURERS**

<u>Mfg. Code</u>	<u>Name and Address</u>	<u>Mfg. Code</u>	<u>Name and Address</u>
0B0A9	Dallas Semiconductor Corp. 4350 Beltwood Parkway S. Dallas, TX 75244	00779	AMP, Inc. P. O. Box 3608 Harrisburg, PA 17150
0EBT2	Andon Electronics Corp. 4 Court Street Lincoln, RI 02865	01295	Texas Instruments, Inc. 13500 No. Central Express Way Dallas, TX 75231

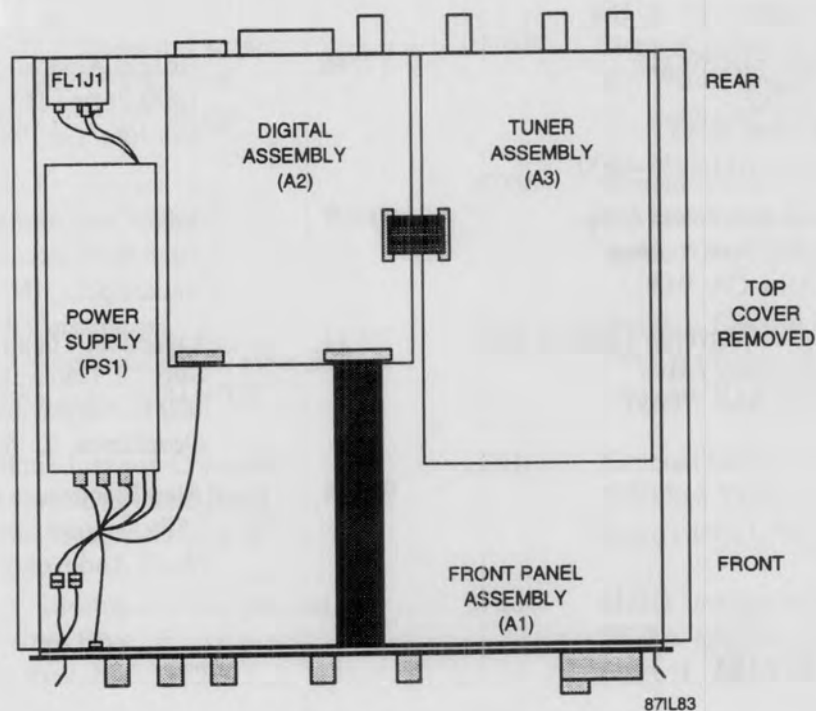
REPLACEMENT PARTS LIST

HF-1000 DIGITAL HF RECEIVER

Replacement parts may be obtained from any manufacture provided that the physical characteristics and electrical parameters of the replacement item are compatible with the original part. In the case where components are identified by a military or industrial specification, a vendor which can provide the necessary component is suggested as a convenience to the user.

**NOTE**

As improved semiconductors become available, it is the policy of Watkins-Johnson to incorporate them in proprietary products. For this reason some transistors, diodes and integrated circuits installed in the equipment may not agree with those specified in the parts list and schematic diagrams of this manual. However, the semiconductors designated in the manual may be substituted in every case with satisfactory results.



**Figure 8-1. HF-1000 Main Chassis Component Locations**

HF-1000 DIGITAL HF RECEIVER

REPLACEMENT PARTS LIST

8.5 TYPE HF-1000 DIGITAL HF RECEIVER

MAIN CHASSIS

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
	Revision J1				
A1	Front Panel Assembly	1	797015-1	14632	
A1A1	Front Panel PC Assembly	1	482108-2	14632	
A1J1	Jack Assembly, Phone	1	382887-1	14632	
A1RV1	Varistor, 275 VAC RMS	1	V275LA4	03508	
A1S1	Switch, Rocker, Power	1	DM24-J72-S2-05-Q-6	OCY71	
A2	Digital Control PC Assembly (Standard)	1	797214-1	14632	
A3	RF Tuner Assembly (.7 PPM Stability) (Standard)	1	797006-6	14632	
FL1J1	Filter/Power	1	FN365-2/05	OKDK8	
PS1	Power Supply Assembly	1	766028-1	14632	
W1	Cable Assembly	1	382892-1	14632	
AI	Accessory Items	1	HF1000/AI	14632	

REPLACEMENT PARTS LIST

HF-1000 DIGITAL HF RECEIVER

8.5.1 TYPE 482108-2 FRONT PANEL PC ASSEMBLY

REF DESIG PREFIX A1A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C1	Revision H1 Capacitor, Ceramic, Axial: .1 $\mu$ F, 50 V, Z5U, $\pm$ 20%	30	SL105E104MAA	51406	
C2					
Thru					
C9					
C10	Capacitor, Ceramic, Axial: .01 $\mu$ , 50 V, Z5U, $\pm$ 20%	4	SL105E103MAA	51406	
C11					
Thru	Same as C10				
C13					
C14	Capacitor, Electrolytic, Aluminum: 470 $\mu$ F, 16 V	2	ECE-ACU471	54473	
C15	Same as C14				
C16					
Thru	Same as C1				
C36					
CR1	Diode	8	1N4449	80131	
CR2					
Thru	Same as CR1				
CR8					
DS1	Display	9	HDLG-2416	28480	
DS2					
Thru	Same as DS1				
DS9					
DS10	Display	8	MAN6480	58361	
DS11					
Thru	Same as DS10				
DS17					
DS18	LED, Lamp	1	HLMP-1503	28480	
DS19	LED, Lamp	9	HLMP-S500	28480	
DS20					
Thru	Same as DS19				
DS27					
DS28	Lamp	1	86	55335	
DS29	Not Installed				
E7	Cable Assembly	1	IDMD-12-T-9-C-R	55322	
J1	Connector, Header, 3 Position, Straight Pin, Friction Lock	1	26-48-2035	27264	
J2	Not Installed				
J3	Connector, Plug, 3 Pin, Straight Post Header	2	640456-3	00779	
J4	Same as J3				
L1	Inductor: 150: $\mu$ H, Power Line Choke, DCR = .24 $\Omega$	1	RL-1284-150	14778	
M1	Meter	1	841710	14632	
QN1	Transistor Array	3	MPQ2907	04713	
QN2	Same as QN1				
QN3	Same as QN1				

HF-1000 DIGITAL HF RECEIVER

REPLACEMENT PARTS LIST

REF DESIG PREFIX A1A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R1	Resistor, Fixed, Film: 10 kΩ, 5%, 1/8 W	9	CF1/8-10K/J	59124	
R2					
Thru	Same as R1				
R4					
R5	Resistor, Fixed, Film: 1.0 kΩ, 5%, 1/8 W	2	CF1/8-1.0K/J	59124	
R6	Same as R1				
R7	Resistor, Variable: 10 kΩ, CW Linear, CP±10%	2	PCW1D-C24-BAB-103	80294	
R8	Resistor, Fixed, Film: 22Ω, 5%, 1/8 W	16	CF1/8-22 OHMS/J	59124	
R9					
Thru	Same as R8				
R11					
R12	Resistor, Fixed, Film: 2.2 kΩ, 5%, 1/8 W	12	CF1/8-2.2K/J	59124	
R13					
Thru	Same as R12				
R23					
R24					
Thru	Same as R8				
R31					
R32	Resistor, Fixed, Film: 33 kΩ, 5%, 1/8 W	1	CF1/8-33K/J	59124	
R33	Resistor, Fixed, Film: 100 kΩ, 5%, 1/8 W	8	CF1/8-100K/J	59124	
R34	Same as R5				
R35					
Thru	Same as R1				
R38					
R39	Same as R7				
R40	Resistor, Variable: 10 kΩ, CW Audio, CP ±10%	1	PCW1D-C24-BAD-103	80294	
R41					
Thru	Same as R8				
R44					
R45					
Thru	Same as R33				
R51					
R52	Resistor, Fixed, Film: 6.8Ω, 5%, 1/4 W	1	CF1/4-6.8 OHMS/J	59124	
R53	Not In Circuit				
R54	Resistor, Fixed, Film: 150Ω, 5%, 1/8 W	1	CF1/8-150 OHMS/J	59124	
S1	Switch, Subminiature, PCB MTG, w/Green LED	17	TR2-21-L5	8S746	
S2	Same as S1				
S3	Same as S1				
S5	Switch, Subminiature, Rubber Contact, PCB Mtg	27	TR1-01	18022	
S6	Same as S5				
S7					
Thru	Same as S1				
S10					



REPLACEMENT PARTS LIST

HF-1000 DIGITAL HF RECEIVER

REF DESIG PREFIX A1A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
S14	Same as S5				
S15	Same as S1				
S16	Same as S1				
S17	Same as S5				
S18	Same as S1				
S19	Same as S5				
S20	Same as S1				
S21	Same as S5				
S22	Same as S5				
S23	Same as S1				
S24					
Thru	Same as S5				
S28					
S29	Same as S1				
S30					
Thru	Same as S5				
S38					
S39					
Thru	Same as S1				
S41					
S42	Same as S5				
S43	Same as S5				
S44	Same as S1				
S45					
Thru	Same as S5				
S48					
U1	Integrated Circuit, MCU: 16-Bit Timer, 8 Channel, 8-Bit A/D Conv, 48-pin Dip	1	MC68HC11A0P	04713	
U2	Integrated Circuit, Octal, D-Type Latch, 20 Pin Dip	2	MM74HC573N	27014	
U3	EPROM, Programmed	1	841676	14632	
U4	Integrated Circuit, CMOS, Quad 2-Input, Nand Gate	1	MM74HC00N	27014	
U5	Integrated Circuit, Buffer, CMOS, Hex Buffer, Ninv	2	MM74HC365N	27014	
U6	Integrated Circuit, CMOS, 3-to-8 LN DCDR/DMUX	2	MM74HG138N	27014	
U7	Same as U6				
U8	Same as U2				
U9	Integrated Circuit, Hex, D-Type Flip-Flop, 16 Pin Dip	1	MM74HC174N	27014	
U10	Integrated Circuit/CMOS, Octal,Dual Flip-Flop,20 PinDip	2	MM74HC273N	27014	
U11	Same as U10				
U12	Integrated Circuit, 1.5Z, Darlington Arrays, Quad Drivers 16 Pin Dip	2	ULN2068B	56289	
U13	Same as U12				
U14	Integrated Circuit, CMOS, Dual, Retriggerable, Monostable Multivibrator	1	MM74HF123AN	27014	

## REF DESIG PREFIX A1A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
U15	Integrated Circuit, BUF, CMOS, HS Hex Schmt, Inv	1	MM74HC14N	27014	
U16	Integrated Circuit, CMOS, Dual D-F-F	2	MM74HC74N	27014	
U17	Same as U16				
U18	Same as U5				
U19	Integrated Circuit, Asynchronous, 7-Bit Binary Counters 14 Pin Dip	1	SN74HC4024N	01295	
U20	Encoder	2	ECT1D-C24-GC0024	80294	
U21	Same as U20				
U22	Encoder, Miniature Panel Mt, Optical Encoder	1	HRPG-A-SCA-19F	28480	
XU3	Socket, Integrated Circuit, 28 Pin	1	ICO-628-SGT	55322	

## 8.5.2 TYPE 797214-1 DIGITAL CONTROL PC ASSEMBLY

REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
	Revision A				
BT1	Not Used				
XBT1	Not Used				
BT2	Not Used				
XBT2	Not Used				
C1	Capacitor, Ceramic, .01 $\mu$ F, 10%	118	841415-019	14632	
C2	Same as C1				
C3	Same as C1				
C4	Capacitor, Ceramic, .033 $\mu$ F, 10%	17	841415-022	14632	
C5	Same as C4				
C6	Same as C4				
C7	Same as C4				
C8	Same as C4				
C9	Same as C4				
C10	Same as C4				
C11	Same as C1				
C12	Capacitor, Ceramic, .1 $\mu$ F, 10%, $\geq$ 50VDC	8	841250-25	14632	
C13	Same as C1				
C14	Capacitor, Ceramic, 75pF, $\sim$ 2%	1	841416-046	14632	
C15	Capacitor, Tantalum, 3.3 $\mu$ F, 20%, 16V	10	841293-10	14632	
C16	Same as C12				
C17	Capacitor, Ceramic, 22pF, 5%	3	841415-003	14632	
C18	Same as C1				
C19	Same as C1				
C20	Capacitor, Ceramic, 100pF, 5%	9	841415-007	14632	
C21	Same as C20				
C22	Same as C20				
C23	Same as C20				
C24	Same as C1				
C25	Capacitor, Electrolytic, Aluminum, 470 F, 16V	1	ECE-A1CU471	54473	
C26	Same as C1				
C27	Capacitor, Ceramic, .047 $\mu$ F, 10%	9	841415-023	14632	
C28	Same as C27				
C29	Same as C1				
C30	Same as C4				
C31	Same as C4				
C32	Same as C1				
C33	Same as C4				
C34	Same as C1				
C35	Same as C15				
C36	Same as C1				
C37	Same as C1				
C38	Same as C12				

REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C39	Same as C1				
C40	Capacitor, Tantalum, 10 $\mu$ F, 20%, 16V	2	841293-16	14632	
C41	Same as C17				
C42	Same as C17				
C43	Same as C12				
C44	Same as C1				
C45	Same as C12				
C46	Same as C40				
C47	Same as C1				
C48	Same as C12				
C49	Capacitor, Ceramic, 470pF, 5%	8	841415-011	14632	
C50	Same as C49				
C51	Same as C49				
C52	Same as C49				
C53	Same as C49				
C54	Same as C1				
C55	Same as C1				
C56	Capacitor, Ceramic, 1000pF, 10%	4	841415-013	14632	
C57	Capacitor, Ceramic, 47pF, 2%	4	841416-041	14632	
C58	Same as C1				
C59	Same as C1				
C60	Same as C1				
C61	Same as C15				
C62	Same as C15				
C63	Same as C15				
C64	Same as C1				
C65	Same as C1				
C66	Same as C1				
C67	Same as C1				
C68	Same as C1				
C69	Same as C1				
C70	Same as C1				
C71	Same as C15				
C72	Same as C56				
C73	Same as C56				
C74	Same as C49				
C75	Same as C27				
C76	Same as C27				
C77	Capacitor, Ceramic, 1500pF, 10%,	3	841415-014	14632	
C78	Same as C27				
C79	Same as C77				
C80	Same as C77				
C81	Capacitor, Ceramic, 820pF, ~2%	3	841416-071	14632	

REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C82	Same as C49				
C83	Same as C1				
C84	Same as C1				
C85	Same as C1				
C86	Same as C49				
C87	Same as C1				
C88	Same as C1				
C89	Same as C1				
C90	Same as C1				
C91	Same as C1				
C92	Same as C1				
C93	Same as C1				
C94	Same as C1				
C95	Same as C1				
C96	Capacitor, Ceramic, 2200pF, 10%	4	841415-015	14632	
C97	Same as C57				
C98	Same as C1				
C99	Same as C1				
C100	Same as C1				
C101	Same as C27				
C102	Same as C1				
C103	Same as C15				
C104	Same as C15				
C105	Same as C4				
C106	Capacitor, Ceramic, 220pF, 5%	1	841415-009	14632	
C107	Same as C1				
C108	Same as C27				
C109	Same as C1				
C110	Same as C1				
C111	Same as C1				
C112	Same as C15				
C113	Capacitor, Ceramic, 330pF, 5%	1	841415-010	14632	
C114	Same as C27				
C115	Same as C57				
C116	Same as C1				
C117	Same as C1				
C118	Same as C96				
C119	Same as C1				
C120	Same as C1				
C121	Same as C15				
C122	Same as C57				
C123	Same as C4				
C124	Same as C96				

## REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C125	Capacitor, Ceramic, 180pF, 2%	1	841416-055	14632	
C126	Capacitor, Ceramic, 470pF, 2%	1	841416-065	14632	
C127	Same as C27				
C128	Capacitor, Ceramic, 68pF, --2%	1	841416-045	14632	
C129	Same as C1				
C130	Same as C1				
C131	Not Used				
C132	Same as C1				
C133	Same as C1				
C134	Same as C1				
C135	Not Used				
C136	Same as C1				
C137	Same as C1				
C138	Same as C81				
C139	Same as C1				
C140	Same as C1				
C141	Same as C1				
C142	Not Used				
C143	Same as C1				
C144	Same as C81				
C145	Same as C1				
C146	Same as C1				
C147	Same as C1				
C148	Capacitor, Ceramic, 100pF, 2%	4	841416-049	14632	
C149	Same as C148				
C150	Same as C148				
C151	Same as C148				
C152	Same as C1				
C153	Same as C1				
C154	Same as C1				
C155	Same as C1				
C156	Same as C1				
C157	Same as C1				
C158	Capacitor, Ceramic, 1000pF, 2%	1	841416-073	14632	
C159	Capacitor, Ceramic, 56pF, 2%	1	841416-043	14632	
C160	Same as C1				
C161	Same as C1				
C162	Capacitor, Ceramic, 1200pF, 2%	1	841416-075	14632	
C163	Capacitor, Tantalum, 68μF, 20%, 6.3V	1	841293-24	14632	
C164	Same as C1				
C165	Same as C1				
C166	Same as C1				
C167	Same as C1				

## REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C168	Same as C1				
C169	Same as C1				
C170	Same as C1				
C171	Same as C56				
C172	Same as C1				
C173	Same as C1				
C174	Same as C1				
C175	Capacitor, Tantalum, 33 $\mu$ F, 20%, 16V	9	841293-22	14632	
C176	Same as C175				
C177	Same as C96				
C178	Same as C1				
C179	Same as C175				
C180	Capacitor, Tantalum, 6.8 $\mu$ F, 20%, 6.3V	2	841293-14	14632	
C181	Same as C180				
C182	Same as C1				
C183	Not Used				
C184	Same as C1				
C185	Same as C12				
C186	Same as C12				
C187	Same as C1				
C188	Same as C1				
C189	Same as C1				
C190	Not Used				
C191	Same as C1				
C192	Same as C4				
C193	Same as C1				
C194	Same as C1				
C195	Same as C1				
C196	Same as C1				
C197	Same as C1				
C198	Not Used				
C199	Not Used				
C200	Same as C1				
C201	Same as C1				
C202	Same as C175				
C203	Same as C175				
C204	Same as C175				
C205	Same as C1				
C206	Same as C20				
C207	Same as C1				
C208	Same as C1				
C209	Same as C1				
C210	Same as C1				

## REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C211	Same as C1				
C212	Same as C1				
C213	Same as C1				
C214	Same as C20				
C215	Same as C20				
C216	Same as C1				
C217	Same as C20				
C218	Same as C1				
C219	Same as C175				
C220	Same as C175				
C221	Same as C175				
C222	Same as C1				
C223	Same as C20				
C224	Same as C1				
C225	Same as C1				
C226	Same as C1				
C227	Same as C1				
C228	Same as C1				
C229	Same as C4				
C230	Same as C1				
C231	Same as C1				
C232	Not Used				
C233	Same as C4				
C234	Not Used				
C235	Same as C1				
C236	Same as C4				
C237	Same as C4				
C238	Not Used				
C239	Not Used				
CR1	Not Used (SOT-23)				
CR2	Diode/Swpin Dual Switching Diode Reverse Voltage	2	MMBD7000LT1	04713	
CR3	Not Used				
CR4	Same as CR2				
CR5	Not Used				
FL1	Filter, 455 kHz Precision Ladder Type	1	CFS-455B	51406	
J1	Connector, Jack, BNC BNC Rt Ang , PCB/Panel MT W/SLDR Mt Posts	1	227677-1	00779	
J2	Phone Jack, 3.5 Dia Mini Phone Jack, RES=30M	1	SJ360	53337	
J3	Connector, 25-Pin D-Sub RT Ang, PC MT	1	DMRSTR25RA05Cg	05574	
J4	CONN 24-Pin Term Strip Gold Flash .100CTRS	4	79223-624	22526	
J5	Connector, Header,6 Pos Pin Friction Lock .156 CTRS	1	26-48-2066	27264	
J6	Not Used				
J7	Same as J4				



## REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
J8	Same as J4				
J9	Same as J4				
J10	Not Used				
J11	Connector, PC,BD 3 Pin SHRD HDR	1	3-102202-4	00779	
J12	Not Used				
J13	Not Used				
J14	Connector, Header, 10 Pin HDR .025SQ X.230 X.10CTR SGLD PLTD	1	TSW105-07-G-D	55322	
J15	Not Used				
J16	Not Used				
JW1	Not Used				
L1	Inductor, 10 $\mu$ H, Surface MT	3	RL-1500-10	14778	
L2	Same as L1				
L3	Same as L1				
L4	Inductor, 1.0 $\mu$ H, ~-20%, @7.96MHZ QMIN-25 370MA Ferrite 1210	9	B82422-A1102-M	25088	
L5	Same as L4				
L6	Same as L4				
L7	Same as L4				
L8	Same as L4				
L9	Same as L4				
L10	Same as L4				
L11	Not Used				
L12	Inductor, 2.2 $\mu$ H	1	841444-009	14632	
L13	Inductor, 4.7 $\mu$ H	1	B82422-A1472-M	25088	
L14	Inductor, 150nH	1	841438-029	14632	
L15	Inductor, 68nH	1	841438-021	14632	
L16	Inductor, 2.7 $\mu$ H	1	841444-011	14632	
L17	Not Used				
L18	Inductor, 1000 $\mu$ H	2	NLF453232-102K	7J069	
L19	Same as L18				
L20	Same as L4				
L21	Same as L4				
L22	Not Used				
L23	Not Used				
Q1	Not Used				
Q2	Transistor	3	MMBT2222ALT1	04713	
Q3	Same as Q2				
Q4	Not Used				
Q5	Not Used				
Q6	Transistor	2	2N7002-LT1	17856	
Q7	Same as Q2				
Q8	Transistor	2	MMBT-3906	04713	

## REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
Q9	Same as Q6				
Q10	Transistor	2	MMBT3904LT1	04713	
Q11	Same as Q8				
Q12	Same as Q10				
R1	Resistor, Fixed, 100k $\Omega$ , 5%	110	841414-121	14632	
R2	Resistor, Fixed, 47 $\Omega$ , 5%	20	841414-041	14632	
R3	Resistor, Fixed, 47k $\Omega$ , 5%	7	841414-113	14632	
R4	Same as R3				
R5	Resistor, Fixed, 100 $\Omega$ , 5%	16	841414-049	14632	
R6	Same as R3				
R7	Resistor, Fixed, 10k $\Omega$ , 5%	43	841414-097	14632	
R8	Resistor, Fixed, 4.7k $\Omega$ , 5%	7	841414-089	14632	
R9	Resistor, Fixed, 2.2k $\Omega$ , 5%	8	841414-081	14632	
R10	Same as R2				
R11	Resistor, Fixed, 820 $\Omega$ , 5%	1	841414-071	14632	
R12	Resistor, Fixed, 680 $\Omega$ , 5%	1	841414-069	14632	
R13	Same as R5				
R14	Same as R5				
R15	Not Used				
R16	Not Used				
R17	Not Used				
R18	Resistor, Fixed, 1.0k $\Omega$ , 5%	23	841414-073	14632	
R19	Jumper .05 $\Omega$ MAX 1A MIN@70C	26	841417	14632	
R20	Same as R19				
R21	Same as R18				
R22	Same as R19				
R23	Not Used				
R24	Same as R18				
R25	Same as R19				
R26	Resistor, Fixed, 1.5k $\Omega$ , 5%	5	841414-077	14632	
R27	Same as R19				
R28	Same as R18				
R29	Resistor, Fixed, 2.7 $\Omega$ , 5%	4	841414-011	14632	
R30	Resistor, Fixed, 22k $\Omega$ , 5%	4	841414-105	14632	
R31	Same as R5				
R32	Same as R30				
R33	Same as R5				
R34	Same as R1				
R35	Same as R19				
R36	Resistor, Fixed, 2.7k $\Omega$ , 5%	2	841414-083	14632	
R37	Same as R18				
R38	Same as R19				
R39	Same as R7				

REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R40	Same as R7				
R41	Same as R18				
R42	Same as R7				
R43	Same as R19				
R44	Not Used				
R45	Same as R18				
R46	Same as R36				
R47	Same as R2				
R48	Same as R1				
R49	Same as R1				
R50	Resistor, Fixed, 470Ω, 5%	10	841414-065	14632	
R51	Not Used				
R52	Resistor, Fixed, 75kΩ, 5%	2	841414-118	14632	
R53	Same as R52				
R54	Same as R1				
R55	Resistor, Fixed, 33kΩ, 5%	5	841414-109	14632	
R56	Resistor, Fixed, 220kΩ, 5%	6	841414-129	14632	
R57	Same as R55				
R58	Same as R56				
R59	Resistor, Fixed, 68kΩ, 5%	4	841414-117	14632	
R60	Same as R18				
R61	Same as R1				
R62	Same as R1				
R63	Same as R50				
R64	Same as R1				
R65	Same as R1				
R66	Same as R1				
R67	Same as R2				
R68	Same as R56				
R69	Same as R56				
R70	Same as R2				
R71	Same as R56				
R72	Same as R56				
R73	Same as R2				
R74	Same as R59				
R75	Same as R18				
R76	Same as R1				
R77	Same as R1				
R78	Same as R9				
R79	Same as R1				
R80	Same as R1				
R81	Same as R18				
R82	Same as R1				

REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R83	Same as R1				
R84	Same as R1				
R85	Not Used				
R86	Same as R1				
R87	Same as R2				
R88	Same as R18				
R89	Same as R9				
R90	Same as R1				
R91	Same as R1				
R92	Same as R1				
R93	Same as R50				
R94	Resistor, Fixed, 18k $\Omega$ , 5 %	4	841414-103	14632	
R95	Same as R2				
R96	Same as R94				
R97	Same as R2				
R98	Same as R3				
R99	Same as R3				
R100	Same as R55				
R101	Same as R8				
R102	Same as R1				
R103	Same as R1				
R104	Same as R1				
R105	Not Used				
R106	Same as R9				
R107	Same as R94				
R108	Same as R9				
R109	Same as R94				
R110	Same as R18				
R111	Same as R7				
R112	Resistor, Fixed, 8.2k $\Omega$ , 5%	2	841414-095	14632	
R113	Same as R112				
R114	Same as R7				
R115	Same as R1				
R116	Not Used				
R117	Same as R7				
R118	Same as R7				
R119	Same as R7				
R120	Same as R1				
R121	Same as R1				
R122	Same as R1				
R123	Same as R1				
R124	Same as R2				
R125	Same as R1				

REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R126	Same as R18				
R127	Same as R59				
R128	Same as R7				
R129	Same as R2				
R130	Same as R1				
R131	Same as R1				
R132	Same as R1				
R133	Resistor, Fixed, 150kΩ, 5%	2	841414-125	14632	
R134	Same as R50				
R135	Same as R7				
R136	Same as R26				
R137	Same as R26				
R138	Same as R30				
R139	Same as R2				
R140	Same as R1				
R141	Same as R1				
R142	Same as R18				
R143	Same as R18				
R144	Same as R1				
R145	Same as R18				
R146	Same as R55				
R147	Resistor, Fixed, 150Ω, 5%	1	841414-053	14632	
R148	Resistor, Fixed, 3.3kΩ, 5%	9	841414-085	14632	
R149	Same as R1				
R150	Same as R1				
R151	Resistor, Fixed, 10Ω, 5%	5	841414-025	14632	
R152	Same as R18				
R153	Same as R18				
R154	Same as R133				
R155	Resistor, Fixed, 4.7Ω, 5%	1	841414-017	14632	
R156	Not Used				
R157	Same as R7				
R158	Same as R7				
R159	Same as R7				
R160	Same as R26				
R161	Same as R26				
R162	Same as R30				
R163	Same as R2				
R164	Same as R3				
R165	Same as R1				
R166	Same as R7				
R167	Same as R7				
R168	Same as R18				

REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R169	Resistor, Fixed, 220Ω, 5%	3	841414-057	14632	
R170	Same as R7				
R171	Same as R1				
R172	Same as R151				
R173	Same as R7				
R174	Same as R7				
R175	Not Used				
R176	Same as R29				
R177	Same as R1				
R178	Same as R7				
R179	Same as R1				
R180	Same as R2				
R181	Not Used				
R182	Not Used				
R183	Same as R2				
R184	Same as R29				
R185	Same as R7				
R186	Same as R19				
R187	Same as R2				
R188	Same as R151				
R189	Not Used				
R190	Same as R29				
R191	Same as R19				
R192	Not Used				
R193	Same as R1				
R194	Same as R1				
R195	Same as R7				
R196	Same as R7				
R197	Same as R148				
R198	Same as R148				
R199	Same as R151				
R200	Same as R18				
R201	Same as R19				
R202	Same as R148				
R203	Same as R148				
R204	Not Used				
R205	Same as R19				
R206	Same as R151				
R207	Same as R1				
R208	Same as R1				
R209	Same as R19				
R210	Same as R1				
R211	Same as R19				

REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R212	Same as R1				
R213	Not Used				
R214	Same as R19				
R215	Same as R1				
R216	Same as R19				
R217	Resistor, Fixed, 5.6kΩ, 5%	1	841414-091	14632	
R218	Same as R148				
R219	Same as R9				
R220	Same as R5				
R221	Same as R5				
R222	Same as R9				
R223	Same as R7				
R224	Same as R1				
R225	Not Used				
R226	Same as R8				
R227	Same as R3				
R228	Same as R8				
R229	Same as R1				
R230	Same as R1				
R231	Same as R19				
R232	Same as R1				
R233	Same as R1				
R234	Not Used				
R235	Same as R1				
R236	Not Used				
R237	Same as R1				
R238	Not Used				
R239	Same as R1				
R240	Same as R7				
R241	Same as R8				
R242	Same as R8				
R243	Same as R7				
R244	Same as R1				
R245	Same as R7				
R246	Same as R1				
R247	Resistor, Fixed, 1.0 MΩ 5%	4	841414-145	14632	
R248	Same as R2				
R249	Same as R1				
R250	Same as R7				
R251	Same as R7				
R252	Same as R2				
R253	Same as R1				
R254	Same as R1				

REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R255	Same as R7				
R256	Same as R1				
R257	Same as R1				
R258	Same as R1				
R259	Same as R1				
R260	Same as R1				
R261	Same as R1				
R262	Not Used				
R263	Not Used				
R264	Not Used				
R265	Same as R5				
R266	Same as R1				
R267	Same as R1				
R268	Same as R1				
R269	Not Used				
R270	Same as R7				
R271	Same as R19				
R272	Same as R1				
R273	Same as R7				
R274	Same as R7				
R275	Same as R1				
R276	Same as R1				
R277	Same as R1				
R278	Same as R7				
R279	Not Used				
R280	Same as R19				
R281	Same as R1				
R282	Same as R1				
R283	Same as R7				
R284	Not Used				
R285	Not Used				
R286	Same as R247				
R287	Not Used				
R288	Same as R1				
R289	Same as R19				
R290	Same as R1				
R291	Not Used				
R292	Same as R1				
R293	Same as R19				
R294	Same as R19				
R295	Not Used				
R296	Same as R19				
R297	Same as R55				



REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R298	Same as R7				
R299	Not Used				
R300	Not Used				
R301	Same as R19				
R302	Same as R5				
R303	Same as R7				
R304	Same as R1				
R305	Same as R1				
R306	Same as R18				
R307	Same as R59				
R308	Same as R7				
R309	Not Used				
R310	Same as R7				
R311	Same as R7				
R312	Same as R1				
R313	Same as R1				
R314	Same as R5				
R315	Same as R7				
R316	Same as R5				
R317	Same as R1				
R318	Same as R5				
R319	Same as R1				
R320	Same as R50				
R321	Same as R1				
R322	Same as R1				
R323	Same as R18				
R324	Same as R5				
R325	Same as R1				
R326	Same as R1				
R327	Same as R18				
R328	Same as R7				
R329	Same as R1				
R330	Same as R9				
R331	Same as R1				
R332	Same as R1				
R333	Resistor, Fixed, 6.8 kΩ, 5%	2	841414-093	14632	
R334	Same as R8				
R335	Not Used				
R336	Same as R1				
R337	Same as R333				
R338	Same as R148				
R339	Same as R148				
R340	Resistor, Fixed, 68Ω, 5%	2	841414-045	14632	

REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R341	Same as R247				
R342	Same as R247				
R343	Same as R2				
R344	Same as R1				
R345	Same as R1				
R346	Same as R1				
R347	Same as R1				
R348	Same as R1				
R349	Same as R1				
R350	Same as R1				
R351	Same as R1				
R352	Same as R1				
R353	Same as R1				
R354	Same as R1				
R355	Same as R1				
R356	Same as R1				
R357	Same as R1				
R358	Same as R1				
R359	Same as R1				
R360	Same as R7				
R361	Same as R340				
R362	Not Used				
R363	Same as R19				
R364	Not Used				
R365	Not Used				
R366	Same as R50				
R367	Same as R5				
R368	Same as R5				
R369	Same as R5				
R370	Same as R50				
R371	Same as R50				
R372	Same as R169				
R373	Same as R50				
R374	Same as R50				
R375	Same as R169				
R376	Same as R19				
R377	Same as R148				
R378	Same as R2				
R379	Not Used				
S1	Switch/Dip SPST Side Actuated Dip	2	ADP-08S	95146	
S2	Same as S1				
T1	Transformer CPLG Audio 600CT/500CT IMP=10%,	2	SPT-130	20462	
T2	Same as T1				

REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
U1	Integrated Circuit, Microcontroller, Microcontroller Unit 16-BIT Timer 8 Channel 8-BIT	1	MC68GC11A0FN	04713	
XU1	Socket 52-POS PLCC .050CTRS 1.050 X .20HT Polarized Surf	1	213-052-601	26742	
U2	Integrated Circuit, TRI-State Octal D-Type Latch SOL-20 Wide Pkg	1	74HC373SOL20	02735	
U3	Integrated Circuit, Octal TRI-State Buffer, SOL-20 Wide Pkg	4	74HC244 SOL20	04713	
U4	Integrated Circuit, Quad 2-Input NAND Gate SO-14N	1	74HC00 SO14	02735	
U5	Integrated Circuit, RAM, 8K X 8 Nonvolatile Time Keeping RAM 120NS=AT 28-Pin	1	DS1643-120	0B0A9	
XU5	Socket, IC 28 Pin .600 Row Spacing On .100 CTRS Gold Contact	2	O-628-SGT	S5322	
U6	Integrated Circuit, CMOS, Triple Three Input OR Gate SO-14 PLSTC PKG	1	74HC4075 SO14	02735	
U7	Integrated Circuit, TRIPLE 3-Input NOR Gates	1	74HC27 SO14	02735	
U8	Integrated Circuit, 3-TO-8 Line Decoder	1	74HC138 SO16	02735	
U9	Integrated Circuit, CMOS, Quad Buffer/Line Driver	2	74HC125 SO14	34371	
U10	Integrated Circuit, Triple 3-Input AND Gate	1	74F11 SO14	04713	
U11	Integrated Circuit, 1-OF-8 Decoder/Demultiplexer	1	74F138 SO16	04713	
U12	EPROMProgrammed	1	842032	14632	
XU12	socket, IC 32-PIN LOW PROFILE DIP Socket .600 Row Space Gold	1	O-632-SGT	S532	
U13	Integrated Circuit, 16-BIT A/D Converter 20-Pin PLSTC DIP	1	DSP56ADC16S	04713	
U14	Same as U3				
U15	Integrated Circuit, Octal D Flip-Flops With Clear SOL-20 Wide Pkg	1	74HC273 SOL20		
U16	Same as U9				
U17	Same as U3				
U18	Not Used				
U19	Same as U3				
U20	Integrated Circuit, Line Driver and Receiver Monolithic 8 Pin PKS	2	SN75155D	01295	
U21	Integrated Circuit, CMOS, Hex Inverters Active Outputs	3	74AC04 SO14	04713	
U22	Amplifier Ultra-High Frequency Op. Amp Gain Bandwidth 1.	1	NE5539D	18324	
U23	Integrated Circuit, Dual D Flip-Flop With Preset and Clear	3	74HC74 SO14	04713	
U24	Integrated Circuit, CMOS, 14-Stage Binary Ripple Counter	2	74HC4020 SO16	34371	
U25	Integrated Circuit, CMOS, Parallel-In/Serial-OUT 8-BIT Shift Register SO-1	1	74HC165 SO16	02735	
U26	Integrated Circuit, /INV Hex Inverter	1	74HC04 SO14	04713	
U27	Integrated Circuit, SYN Presettable Binary Counter	2	74AC161 SO16	34371	

REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
U28	Same as U27				
U29	Same as U23				
U30	Integrated Circuit,Synchronous Binary Counter with Asynchronous Clear SO	1	74HC161 SO16	02735	
U31	Same as U23				
U32	Same as U21				
U33	Integrated Circuit, CMOS,Dual D Flip-Flop With PRESET AND CLEAR	1	74AC74CO14	02735	
U34	Voltage Regulator3 TERM NEG Volt Regulator -5V	1	MC79M05CDT	04713	
U35	Same as U24				
U36	Same as U21				
U37	Integrated Circuit,40 MHZ DSP Microprocessor with PLL 24-BIT 132-PIN PQF	1	DSP56002FC40	04713	
U38	Same as U20				
U39	Integrated Circuit, /SRAMCMOS,32K X 8 20NS Access Time 28PIN SOJ	6	MT5C2568DJ-20	6Y440	
U40	Same as U39				
U41	Same as U39				
U42	Integrated Circuit, /Sensing Undervoltage Sensing Rest Operation W/1V Input	1	MC34064D-5	04713	
U43	Not Used				
U44	Integrated Circuit, Differential Bus Transceiver	2	SN75176AD	01295	
U45	Same as U39				
U46	Same as U39				
U47	Same as U39				
U48	Integrated Circuit, Octal D Flip-Flop with RESET SOL-20 PKG	2	74HCT273 SOL20	02735	
U49	Integrated Circuit, Dual D Flip-Flop with SET and RESET	1	74HCT74 SO14	34371	
U50	Same as U48				
U51	Integrated Circuit, /CONV D/A Monolithic 8-BIT HS Current Output	2	DAC0800LCM	27014	
U52	Amplifier JFET-Input Dual OP AMP	7	MC34002D	04713	
U53	Integrated Circuit, Quad 2-Input AND Gate	1	74HC08 SO14	02735	
U54	Same as U52				
U55	Same as U51				
U56	EPROM Programmed	1	842033	14632	
XU56	Same as XU5				
U57	Same as U44				
U58	Integrated Circuit, Dual 1-OF-4 Decoder/Demultiplexer	1	74F139 SO16	04713	
U59	Integrated Circuit, /CONV D/A 16 Bit Audio D/A Converter	1	AD1851R	24355	
U60	Integrated Circuit, CMOS,Triple 2-Channel Analog Multiplexer/Demultiplexer	3	74HC4053 SO16	02735	

REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
U61	Same as U52				
U62	Same as U60				
U63	Same as U52				
U64	Same as U52				
U65	Amplifier Single Low Noise OP AMP SO 8 PIN	3	NE5534D	18324	
U66	Same as U65				
U67	Integrated Circuit, Dynamic Range Processor Dual VCA 16-Pin DIP	1	SSM-2122P	06665	
U68	Same as U60				
U69	Amplifier JFET-Input Operational Amplifier	2	MC34001D	04713	
U70	Same as U69				
U71	Same as U52				
U72	Integrated Circuit, /AMP 1.5W Audio Power AMP 14-PIN DIP	1	LM388n-1	27014	
U73	Not Used				
U74	Same as U52				
U75	Same as U65				
VR1	Not Used				
XTB1	Connector, Header,13-POS Shrouded PC MT	1	ELFH13210	58982	
Y1	Not Used				

8.5.3 TYPE 797006-1 RF TUNER PC ASSEMBLY

REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
	Revision N1				
C1	Not Used				
C2	Not Used				
C3	Capacitor, Ceramic: .01 $\mu$ F, 10%, 50 V	140	841415-019	14632	
C4	Same as C3				
C5	Same as C3				
C6	Not Used				
C7					
Thru	Same as C3				
C10					
C11	Capacitor, Ceramic: 56 pF, 2%, 50 V NPO	4	841416-043	14632	
C12	Capacitor, Ceramic: .1 $\mu$ F, 10%, 50 VDC	80	841250-25	14632	
C13	Same as C12				
C14	Same as C12				
C15	Same as C3				
C16	Same as C12				
C17					
Thru	Same as C3				
C22					
C23	Capacitor, Ceramic: 160 pF, 2%, 50 V NPO	2	841414-054	14632	
C24	Not Used				
C25	Capacitor, Ceramic: 8.2 pF, $\pm$ 25 pF, 50 V	1	8414116-023	14632	
C26	Same as C23				
C27	Capacitor, Ceramic: 27 pF, 2%, 50 V NPO	3	841416-035	14632	
C28	Same as C11				
C29	Capacitor, Ceramic: 82 pF, $\pm$ 2%, 50 V NPO	3	841416-047	14632	
C30	Not Used				
C31	Same as C3				
C32	Same as C3				
C33					
Thru	Same as C12				
C37					
C38	Capacitor, Ceramic: 22 pF, 5%, 50 V NPO	6	841415-003	14632	
C39					
Thru	Same as C3				
C41					
C42	Same as C38				
C43	Capacitor, Ceramic: 91 pF, $\pm$ 2%, 50 V NPO	2	841416-048	14632	
C44	Capacitor, Ceramic: 33 pF, $\pm$ 2%, 50 V NPO	1	841416-037	14632	
C45	Capacitor, Ceramic: 130 pF, 2%, 50 V NPO	1	841416-052	14632	
C46	Same as C43				
C47	Capacitor, Ceramic: 100 pF, 2%, 50 V NPO	9	841416-049	14632	
C48	Capacitor, Ceramic: 1500 pF, 10%, 50 V	3	841415-014	14632	

REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C49	Capacitor, Ceramic: 470 pF, 5%, 50 V NPO	3	841415-011	14632	
C50	Not Used				
C51	Same as C47				
C52	Same as C3				
C53	Same as C3				
C54	Same as C12				
C55	Same as C12				
C56	Same as C3				
C57	Same as C38				
C58	Same as C3				
C59	Same as C38				
C60	Same as C3				
C61	Capacitor, Tantalum: 2.2 μF, 20%, 20 V	4	841293-09	f14632	
C62	Same as C3				
C63	Capacitor, Tantalum: 3.3 μF, 20%, 16 V	13	841293-10	14632	
C64	Same as C3				
C65	Same as C3				
C66	Same as C61				
C67	Same as C3				
C68	Capacitor, Tantalum: 33 μF, 20%, 16 V	15	841293-22	14632	
C69					
Thru	Same as C12				
C75					
C76	Same as C61				
C77	Same as C61				
C78	Capacitor, Ceramic: 1000 pF, 10%, 50 V	10	841415-013	14632	
C79	Same as C68				
C80					
Thru	Same as C3				
C84					
C85	Capacitor, Tantalum: 4.7 μF, 20%, 25 V	2	841293-13	14632	
C86					
Thru	Same as C12				
C89					
C90	Same as C68				
C91	Same as C12				
C92	Not Used				
C93	Same as C3				
C94	Capacitor, Ceramic: 2200 pF, 10%, 50 V	7	841415-015	14632	
C95	Same as C78				
C96	Same as C78				
C97	Same as C94				
C98	Same as C3				

REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C99	Same as C3				
C100	Not Used				
C101	Same as C3				
C102					
Thru	Same as C12				
C110					
C111					
Thru	Same as C3				
C113					
C114	Capacitor, Tantalum: 6.8 $\mu$ F, 20%, 6.3 V	2	841293-14	14632	
C115					
Thru	Same as C3				
C118					
C119	Capacitor, Ceramic: 68 pF, 5%, 50 V NPO	2	841415-006	14632	
C120	Same as C114				
C121	Same as C12				
C122	Same as C12				
C123	Same as C63				
C124					
Thru	Same as C3				
C126					
C127					
Thru	Same as C12				
C131					
C132	Same as C3				
C133	Same as C12				
C134	Same as C12				
C135	Same as C3				
C136	Same as C3				
C137	Same as C63				
C138	Same as C12				
C139	Same as C3				
C140	Same as C47				
C141	Same as C3				
C142	Same as C47				
C143	Same as C3				
C144	Capacitor, Ceramic: 47 pF, 5%, 50 V NPO	3	841415-005	14632	
C145	Same as C63				
C146	Same as C12				
C147					
Thru	Same as C3				
C154					
C155	Same as C12				
C156	Same as C3				
C157	Same as C144				
C158	Same as C3				



REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C159	Same as C3				
C160	Same as C12				
C161	Same as C12				
C162	Not Used				
C163	Same as C3				
C164	Same as C3				
C165	Not Used				
C166	Same as C3				
C167	Same as C68				
C168	Same as C3				
C169	Same as C3				
C170	Same as C47				
C171					
Thru	Same as C3				
C173					
C174	Not Used				
C175	Same as C49				
C176	Same as C78				
C177	Same as C63				
C178	Same as C78				
C179	Same as C119				
C180	Capacitor, Ceramic: 39 pF, 2%, 50 V NPO	1	841416-039	14632	
C181	Same as C12				
C182	Same as C12				
C183	Same as C3				
C184	Not Used				
C185	Same as C47				
C186	Same as C3				
C187	Same as C94				
C188	Same as C144				
C189	Same as C47				
C190					
Thru	Same as C3				
C192					
C193	Not Used				
C194	Same as C78				
C195					
Thru	Same as C3				
C197					
C198	Same as C85				
C199	Same as C3				
C200	Same as C68				
C201	Same as C49				
C202	Not Used				

REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C203	Same as C47				
C204	Same as C12				
C205	Capacitor, Tantalum: .33 $\mu$ F, 20%, 35 V	8	841293-01	14632	
C206	Same as C12				
C207					
Thru	Not Used				
C211					
C212	Same as C78				
C213	Same as C47				
C214	Same as C3				
C215	Same as C3				
C216	Capacitor, Ceramic: .033 $\mu$ F, 10%, 50 V	8	841415-022	14632	
C217	Same as C63				
C218	Same as C38				
C219	Same as C216				
C220	Same as C3				
C221	Not Used				
C222	Same as C3				
C223	Same as C3				
C224	Not Used				
C225	Not Used				
C226	Same as C3				
C227	Same as C3				
C228	Same as C216				
C229	Same as C3				
C230	Same as C216				
C231	Same as C3				
C232	Not Used				
C233	Same as C3				
C234					
Thru	Not Used				
C240					
C241					
Thru	Same as C3				
C245					
C246					
Thru	Same as C68				
C249					
C250	Same as C216				
C251	Same as C3				
C252	Same as C38				

REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C253					
Thru	Same as C3				
C255					
C256	Capacitor, Tantalum: 68 $\mu$ F, 20%, 6.3 V	2	841293-24	14632	
C257	Same as C68				
C258	Same as C216				
C259	Same as C78				
C260	Same as C78				
C261	Same as C3				
C262	Same as C3				
C263	Same as C94				
C264	Capacitor, Ceramic: 330 pF, 5%, 50 V NPO	2	841415-010	14632	
C265					
Thru	Not Used				
C267					
C268	Same as C48				
C269	Same as C94				
C270	Same as C63				
C271	Same as C63				
C272	Same as C3				
C273	Same as C12				
C274	Same as C12				
C275	Same as C63				
C276	Same as C3				
C277	Same as C63				
C278	Same as C205				
C279	Same as C12				
C280	Same as C3				
C281	Same as C68				
C282	Same as C256				
C283	Same as C68				
C284	Same as C68				
C285	Same as C3				
C286	Same as C3				
C287	Same as C78				
C288	Same as C3				
C289	Same as C3				
C290	Same as C12				
C291	Same as C3				
C292	Capacitor, Ceramic: 2.2 pF, $\pm$ 1 pF, 50 V NPO	3	841416-009	14632	
C293	Same as C292				
C294	Same as C3				
C295	Same as C27				

## REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C296	Same as C3				
C297	Same as C3				
C298	Same as C3				
C299	Same as C11				
C300	Same as C3				
C301	Same as C11				
C302					
Thru	Same as C3				
C304					
C305	Same as C68				
C306	Same as C3				
C307	Same as C3				
C308	Not Used				
C309	Not Used				
C310					
Thru	Same as C3				
C312					
C313	Same as C68				
C314	Not Used				
C315	Same as C27				
C316	Same as C292				
C317	Same as C12				
C318	Capacitor, Ceramic: 22 pF, 2%, 50 V NPO	2	841416-033	14632	
C319	Same as C318				
C319	Same as C318				
C320					
Thru	Same as C3				
C325					
C326	Same as C12				
C327	Same as C12				
C328	Same as C48				
C329	Same as C264				
C330					
Thru	Same as C3				
C334					
C335	Same as C29				
C336					
Thru	Same as C3				
C338					
C339	Same as C12				
C340	Same as C29				
C341	Same as C12				
C342	Same as C63				

REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C343	Same as C12				
C344	Same as C63				
C345	Same as C12				
C346	Same as C205				
C347					
Thru	Same as C12				
C350					
C351	Same as C205				
C352					
Thru	Same as C12				
C354					
C355	Same as C205				
C356	Same as C12				
C357	Same as C3				
C358	Same as C205				
C359	Same as C3				
C360	Same as C94				
C361	Same as C216				
C362	Same as C94				
C363	Same as C3				
C364					
Thru	Same as C12				
C366					
C367	Same as C63				
C368					
Thru	Same as C12				
C370					
C371	Same as C205				
C372	Same as C12				
C373	Same as C12				
C374	Same as C205				
C375					
Thru	Same as C12				
C377					
C378	Same as C216				
CR1	Dual Switching Diode	17	MMBD7000LT1	04713	
CR2	Diode	6	BB620(Q62702-B403)	25088	
CR3					
Thru	Same as CR1				
CR10					
CR11	Same as CR2				
CR12	Same as CR2				
CR13	Same as CR1				

REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
CR14	Same as CR1				
CR15	Same as CR2				
CR16	Same as CR2				
CR17	Same as CR1				
CR18	Diode	6	FDSO1503	27014	
CR19					
Thru	Same as CR18				
CR23					
CR24	Diode	6	HSMP-3800-T31	28480	
CR25					
Thru	Same as CR24				
CR29					
CR30	Same as CR1				
CR31	Same as CR2				
CR32					
Thru	Same as CR1				
CR35					
E1	Cable Assembly	1	IDMD-12-T-4-C	55322	
FB1	Ferrite Bead: 120Ω, ±25%	10	CB30-453215T	54583	
FB2					
Thru	Same as FB1				
FB10					
FL1	Filter, BP: 40.455 MHz, BW = 8 kHz	1	92727	14632	
FL2	Filter: 455 kHz	1	CFS-455B	51406	
J1	Connector, Jack, BNC	3	227677-1	00779	
J2	Same as J1				
J3	Same as J1				
J4	Not Used				
J5	Connector	1	79223-610	22526	
L1	Inductor: 1000 μH, 10%	6	841699-037	14632	
L2	Inductor: 10 μH, 10%	2	841699-013	14632	
L3	Inductor: 22 nH, ±5%	1	841438-009	14632	
L4	Inductor: 15 nH, ±5%	1	841438-005	14632	
L5	Inductor: 4700 nH, 10%	12	841698-033	14632	
L6	Inductor: 47 μH, ±10%	2	NL322522-470K	54583	
L7	Inductor: 150 nH, ±5%	2	841438-029	14632	
L8	Inductor: 68 nH, ±5%	2	841438-021	14632	
L9	Inductor: 4.7 μH, ±20%	4	B82422-A1472-M	25088	
L10	Same as L6				
L11	Same as L7				
L12	Same as L8				
L13	Same as L9				
L14	Same as L9				

REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
L15					
Thru	Same as L5				
L17					
L18	Inductor: 270 $\mu$ F, $\pm$ 5%	2	841438-035	14632	
L19	Inductor: 330 nH, $\pm$ 5%	1	841438-037	14632	
L20	Inductor: 220 nH, $\pm$ 5%	4	841438-033	14632	
L21	Inductor: 160 nH, $\pm$ 5%	1	841438-030	14632	
L22	Inductor: 180 nH, $\pm$ 5%	1	841438-031	14632	
L23	Inductor: 240 nH, $\pm$ 5%	1	841438-034	14632	
L24	Same as L1				
L25	Inductor: 150 $\mu$ H, 10%	2	841699-027	14632	
L26	Same as L25				
L27	Same as L1				
L28	Same as L1				
L29	Inductor: 270 $\mu$ H, 10%	13	841699-030	14632	
L30	Same as L29				
L31	Inductor: 47 $\mu$ H, 10%	4	841699-021	14632	
L32	Same as L31				
L33	Same as L31				
L34	Same as L9				
L35	Same as L29				
L36	Same as L20				
L37	Inductor: 100 nH, $\pm$ 5%	2	841438-025	14632	
L38	Same as L37				
L39	Inductor: 4700 nH, 10%	1	841698-033	14632	
L40	Same as L5				
L41	Same as L5				
L42	Same as L18				
L43					
Thru	Same as L29				
L45					
L46					
Thru	Same as L5				
L48					
L49					
Thru	Same as L29				
L52					
L53	Not Used				
L54	Same as L29				
L55					
Thru	Not Used				
L57					
L58	Same as L29				

REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
L59	Same as L29				
L60	Inductor: 470 nH, $\pm 5\%$	2	841438-041	14632	
L61	Same as L60				
L62	Same as L20				
L63	Same as L20				
L64	Same as L1				
L65	Same as L1				
L66	Same as L2				
L67	Same as L31				
L68	Same as L5				
L69	Same as L5				
L70	Not Used				
L71	Same as L5				
Q1	Transistor	1	MMBR2857	04713	
Q2	Transistor	15	MMBT3904LT1	04713	
Q3	Same as Q2				
Q4	Same as Q4				
Q6	Transistor	3	OST310	17856	
Q7	Transistor	6	MMBTH69LT1	04713	
Q8	Same as Q7				
Q9					
Thru	Same as Q2				
Q12					
Q13	Same as Q4				
Q14	Same as Q2				
Q15	Transistor	1	2N7002	17856	
Q16	Same as Q6				
Q17	Same as Q7				
Q18	Same as Q7				
Q19	Same as Q4				
Q20	Same as Q7				
Q21	Same as Q7				
Q22	Same as Q2				
Q23	Transistor	1	841381-2	14632	
Q24	Same as Q4				
Q25	Same as Q2				
Q26	Same as Q4				
Q27	Same as Q2				
Q28	Same as Q4				
Q29	Same as Q2				
Q30	Same as Q4				
Q31	Same as Q4				
Q32	Transistor	4	MRF5812	04713	



REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
Q33					
Thru	Same as Q32				
Q35					
Q36	Same as Q2				
Q37	Transistor	2	MMBT3960A	04713	
Q38	Same as Q37				
Q39	Same as Q6				
Q40	Same as Q4				
Q41	Transistor	2	MTD10N05E	04713	
Q42	Same as Q4				
Q43	Transistor	1	MTD4P05	04713	
Q44	Same as Q41				
Q45	Same as Q2				
Q46	Same as Q2				
Q47	Same as Q4				
Q48	Same as Q2				
Q49					
Thru	Same as Q4				
Q54					
R1	Resistor, Fixed: 1.0 k $\Omega$ , 5%, 1/10 W	29	841414-073	14632	
R2	Resistor, Fixed: 680 $\Omega$ , 5%, 1/10 W	22	841414-069	14632	
R3	Same as R1				
R4	Jumper	26	841417	14632	
R5	Same as R4				
R6	Same as R2				
R7	Same as R4				
R8	Resistor, Fixed: 100 k $\Omega$ , 5%, 1/10 W	14	841414-121	14632	
R9	Same as R2				
R10	Resistor, Fixed: 10 $\Omega$ , 5%, 1/10 W	35	841414-025	14632	
R11	Resistor, Fixed: 10 k $\Omega$ , 5%, 1/10 W	19	841414-097	14632	
R12	Same as R11				
R13	Same as R1				
R14	Same as R8				
R15	Resistor, Fixed: 1.5 M $\Omega$ , 5%, 1/10 W	5	841414-149	14632	
R16	Same as R10				
R17	Resistor, Fixed: 680 k $\Omega$ , 5%, 1/10 W	5	841414-141	14632	
R18	Resistor, Fixed: 6.8 k $\Omega$ , 5%, 1/10 W	5	841414-093	14632	
R19	Resistor, Fixed: 120 k $\Omega$ , 5%, 1/10 W	2	841414-123	14632	
R20	Resistor, Fixed: 12 k $\Omega$ , 5%, 1/10 W	6	841414-099	14632	
R21	Resistor, Fixed: 4.7 k $\Omega$ , 5%, 1/10 W	16	841414-089	14632	
R22	Same as R10				
R23	Same as R20				
R24	Resistor, Fixed: 27 k $\Omega$ , 5%, 1/10 W	6	841414-107	14632	
R25	Same as R20				
R26	Same as R24				
R27	Same as R21				

REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R28	Same as R10				
R29	Resistor, Fixed: 68 kΩ, 5%, 1/10 W	2	841414-117	14632	
R30	Same as R15				
R31	Same as R29				
R32	Same as R15				
R33	Same as R10				
R34	Resistor, Fixed: 2.2 kΩ, 5%, 1/10 W	8	841414-081	14632	
R35	Same as R15				
R36	Same as R15				
R37	Same as R17				
R38	Not Used				
R39	Same as R11				
R40	Resistor, Fixed: 330Ω, 5%, 1/10 W	7	841414-061	14632	
R41	Same as R8				
R42	Resistor, Fixed: 3.3 kΩ, 1/10 W	10	841414-085	14632	
R43	Same as R1				
R44	Resistor, Fixed: 470Ω, 5%, 1/10 W	19	841414-065	14632	
R45	Same as R1				
R46	Resistor, Fixed: 15 kΩ, 5%, 1/10 W	5	841414-101	14632	
R47	Not Used				
R48	Same as R11				
R49	Same as R19				
R50	Same as R10				
R51	Same as R42				
R52	Resistor, Fixed: 100Ω, 5%, 1/10 W	17	841414-049	14632	
R53	Same as R52				
R54	Same as R10				
R55	Same as R8				
R56	Resistor, Fixed: 22 kΩ, 5%, 1/10 W	3	841414-105	14632	
R57	Same as R8				
R58	Same as R56				
R59	Resistor, Variable: 10 kΩ	1	3269X-1-103	80294	
R60	Same as R11				
R61	Same as R10				
R62	Same as R46				
R63	Same as R1				
R64	Same as R1				
R65	Not Used				
R66	Resistor, Fixed: 470 kΩ, 5%, 1/10 W	2	841414-137	14632	
R67	Same as R10				
R68	Same as R11				
R69	Same as R18				
R70	Same as R44				
R71	Same as R10				
R72	Same as R10				
R73	Same as R1				

REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R74	Same as R52				
R75	Same as R34				
R76	Same as R8				
R77	Same as R11				
R78	Same as R11				
R79	Same as R10				
R80	Resistor, Fixed: 1.5 k $\Omega$ , 5%, 1/10 W	12	841414-077	14632	
R81	Resistor, Fixed: 150 $\Omega$ , 5%, 1/10 W	6	841414-053	14632	
R82	Resistor, Fixed: 470 $\Omega$ , 5%, 1/8 W	3	841296-057	14632	
R83	Same as R44				
R84	Same as R82				
R85	Same as R82				
R86	Same as R24				
R87	Resistor, Fixed: 120 $\Omega$ , 5%, 1/10 W	4	841414-051	14632	
R88	Resistor, Fixed: 270 $\Omega$ , 5%, 1/10 W	2	841414-059	14632	
R89	Same as R24				
R90	Same as R21				
R91	Same as R66				
R92	Same as R44				
R93	Same as R2				
R94	Same as R81				
R95	Resistor, Fixed: 22 $\Omega$ , 5%, 1/10 W	7	841414-033	14632	
R96	Same as R52				
R97	Same as R34				
R98	Same as R80				
R99	Resistor, Fixed: 120 $\Omega$ , 5%, 1/8 W	5	841296-043	14632	
R100	Same as R99				
R101	Same as R99				
R102	Same as R81				
R103	Same as R99				
R104	Resistor, Fixed: 180 $\Omega$ , 5%, 1/10 W	5	841414-055	14632	
R105	Same as R52				
R106	Same as R10				
R107	Same as R99				
R108	Same as R95				
R109	Same as R10				
R110	Same as R87				
R111	Same as R52				
R112	Same as R10				
R113	Same as R24				
R114	Resistor, Fixed: 220 $\Omega$ , 5%, 1/10 W	10	841414-057	14632	
R115	Same as R114				
R116	Same as R2				

REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR				
R117	Resistor, Fixed: 47Ω, 5%, 1/10 W	15	841414-041	14632					
R118	Same as R87								
R119	Same as R1								
R120	Same as R1								
R121	Same as R87								
R122	Same as R1								
R123	Resistor, Fixed: 68Ω, 5%, 1/10 W					5	841414-045	14632	
R124	Same as R123								
R125									
Thru	Same as R44								
R127									
R128	Same as R123								
R129	Same as R80								
R130	Same as R1								
R131	Same as R44								
R132	Same as R21								
R133	Resistor, Fixed: 33 kΩ, 5%, 1/10 W	3	841414-109	14632					
R134	Same as R21								
R135	Same as R44								
R136	Same as R21								
R137	Same as R133								
R138	Same as R21								
R139	Same as R21								
R140	Same as R114								
R141	Same as R21								
R142	Same as R133								
R143	Same as R21								
R144	Same as R10								
R145									
Thru	Same as R8								
R147									
R148	Same as R114								
R149	Resistor, Fixed: 2.7 kΩ, 5%, 1/10 W	8	841414-083	14632					
R150									
Thru	Same as R21								
R152									
R153	Same as R24								
R154	Same as R20								
R155	Same as R8								
R156	Same as R10								
R157	Same as R11								
R158	Same as R149								
R159	Same as R11								

REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R160	Same as R21				
R161	Same as R21				
R162	Same as R52				
R163	Same as R42				
R164	Same as R44				
R165	Same as R10				
R166	Same as R88				
R167	Same as R149				
R168	Same as R42				
R169	Same as R10				
R170	Same as R1				
R171	Same as R149				
R172	Same as R42				
R173	Resistor, Fixed: 560Ω, 5%, 1/10 W	5	841414-067	14632	
R174	Same as R42				
R175	Not Used				
R176	Same as R4				
R177	Same as R114				
R178	Same as R149				
R179	Same as R10				
R180	Same as R2				
R181	Same as R117				
R182	Same as R80				
R183	Same as R2				
R184	Same as R10				
R185	Not Used				
R186	Same as R81				
R187	Same as R40				
R188	Same as R81				
R189	Same as R117				
R190	Same as R2				
R191	Resistor, Fixed: 3.3Ω, 5%, 1/10 W	2	841414-013	14632	
R192	Same as R191				
R193	Same as R4				
R194	Resistor, Fixed: 33Ω, 5%, 1/10 W	4	841414-037	14632	
R195	Same as R34				
R196	Same as R8				
R197	Same as R10				
R198	Same as R10				
R199	Same as R2				
R200	Same as R2				
R201	Same as R1				
R202	Same as R46				

REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R203	Same as R52				
R204	Same as R117				
R205	Same as R44				
R206	Same as R8				
R207	Same as R40				
R208	Same as R44				
R209	Same as R4				
R210	Same as R194				
R211	Same as R117				
R212	Same as R2				
R213	Same as R42				
R214	Same as R2				
R215	Same as R42				
R216					
Thru	Same as R4				
R218					
R219	Same as R10				
R220	Same as R114				
R221	Same as R42				
R222	Same as R4				
R223	Same as R2				
R224	Same as R4				
R225	Same as R4				
R226	Same as R10				
R227	Same as R10				
R228	Same as R2				
R229	Same as R1				
R230	Same as R1				
R231	Same as R10				
R232	Same as R42				
R233	Same as R80				
R234	Same as R10				
R235	Same as R80				
R236					
Thru	Same as R4				
R241					
R242	Same as R1				
R243	Same as R1				
R244	Same as R4				
R245	Same as R17				
R246					
Thru	Same as R11				
R248					

REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R249	Resistor, Fixed: 5.6 kΩ, 5%, 1/10 W	6	841414-091	14632	
R250	Same as R249				
R251	Same as R10				
R252	Same as R44				
R253	Same as R114				
R254	Same as R117				
R255	Same as R8				
R256	Same as R1				
R257	Same as R46				
R258					
Thru	Same as R2				
R261					
R262	Same as R10				
R263					
Thru	Same as R4				
R265					
R266	Same as R11				
R267	Same as R10				
R268	Same as R34				
R269	Same as R10				
R270	Same as R21				
R271	Same as R17				
R272	Same as R56				
R273	Same as R11				
R274	Same as R17				
R275	Same as R2				
R276	Same as R52				
R277	Same as R2				
R278	Same as R1				
R279	Same as R1				
R280	Same as R34				
R281	Same as R8				
R282	Same as R117				
R283	Same as R1				
R284	Same as R95				
R285	Same as R1				
R286	Same as R18				
R287	Same as R80				
R288	Same as R249				
R289	Same as R173				
R290	Resistor, Fixed: 2.7Ω, 5%, 1/10 W	2	841414-011	14632	
R291	Same as R11				
R292	Same as R11				

REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R293	Same as R10				
R294	Same as R4				
R295	Same as R44				
R296	Same as R4				
R297	Same as R114				
R298	Same as R11				
R299	Same as R34				
R300	Same as R52				
R301	Same as R52				
R302	Same as R123				
R303	Same as R123				
R304	Same as R104				
R305	Same as R104				
R306	Same as R40				
R307	Same as R117				
R308	Same as R1				
R309	Same as R117				
R310	Same as R40				
R311	Same as R149				
R312	Same as R95				
R313	Same as R117				
R314	Same as R80				
R315	Same as R18				
R316	Same as R117				
R317	Same as R1				
R318	Same as R117				
R319	Same as R40				
R320	Same as R117				
R321	Same as R149				
R322	Same as R4				
R323	Same as R20				
R324	Same as R52				
R325	Same as R4				
R326	Same as R20				
R327	Same as R80				
R328	Same as R52				
R329	Same as R173				
R330	Same as R173				
R331	Same as R95				
R332	Same as R52				
R333	Same as R95				
R334	Same as R249				
R335	Same as R1				



REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R336	Same as R173				
R337	Same as R52				
R338	Same as R104				
R339	Same as R114				
R340	Same as R44				
R341	Same as R117				
R342	Same as R290				
R343	Same as R44				
R344	Same as R44				
R345	Same as R18				
R346	Same as R80				
R347	Same as R1				
R348	Same as R149				
R349	Same as R44				
R350	Same as R52				
R351	Same as R34				
R352	Same as R2				
R353	Same as R44				
R354	Same as R52				
R355	Same as R11				
R356	Same as R1				
R357	Same as R1				
R358	Same as R80				
R359	Same as R80				
R360	Same as R114				
R361	Same as R117				
R362	Same as R81				
R363	Same as R249				
R364	Same as R104				
R365	Same as R46				
R366	Same as R194				
R367	Same as R10				
R368	Same as R249				
R369	Same as R194				
R370	Same as R40				
R371	Same as R10				
R372	Same as R95				
R373	Same as R2				
R374	Resistor, Fixed: 180Ω, 5%, 1/8 W	1	841296-047	14632	
T1	Transformer	1	841709-1	14632	
T2	Transformer	2	458DB-1011=P1	9AA39	
T3	Same as T2				
T4	Transformer	1	458PS-1007=T1	9AA39	

REF DESIG PREFIX A3

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
U1	Integrated Circuit	1	8674HC08SO14U	14632	
U2	Integrated Circuit	1	8674HC32SO14U	14632	
U3	Integrated Circuit	1	8674HC138SO16U	14632	
U4	Integrated Circuit/CMOS	1	8674HC4094SO16U	14632	
U5	Integrated Circuit	2	8674HC00SO14U	14632	
U6	Amplifier	1	86062SO8	14632	
U7	Integrated Circuit	3	MC145158DW-2	04713	
U8	Integrated Circuit	1	8674HC02SO14U	14632	
U9	OSC/TCVXO, ±0.1 PPM	1	92731	14632	
U10	Integrated Circuit/CMOS	3	8674AC00SO14U	04713	
U11	Integrated Circuit	1	TL431CD	04713	
U12	Same as U2				
U13	Integrated Circuit/CMOS	1	MB87086APF	61271	
U14	Amplifier	10	NE5534D	18324	
U15	Same as U7				
U16	Same as U14				
U17	Integrated Circuit	1	MB504PF	61271	
U18	Integrated Circuit	1	SP8792/MP	52648	
U19	Integrated Circuit/CMOS	1	8674AC74S014	14632	
U20	Same as U5				
U21					
Thru	Same as U14				
U25					
U26	Mixer, Balanced	1	NE602D	18324	
U27	Same as U10				
U28	Integrated Circuit	1	SD5400CY	17856	
U29	Amplifier	1	LH2422AJ	27014	
U30	Mixer	1	LRMS-1-TR	15542	
U31	Integrated Circuit/CMOS	1	8674HC4053SO16U	14632	
U32	Same as U14				
U33	Integrated Circuit/CMOS	1	8674AC86S014	14632	
U34	Same as U10				
U35	Same as U7				
U36	Same as U14				
U37	Integrated Circuit	1	8674HC74SO14U	14632	
U38	Not Used				
U39	Amplifier	3	86061SO08	14632	
U40	Same as U39				
U41	Same as U14				
VR1	Diode, Zener	2	MMBZ5231BLT1	04713	
VR2	Same as VR1				
VR3	Diode, Zener	1	MMBZ5235BLT1	04713	

8.5.4 TYPE HF1000/AI ACCESSORY ITEMS

REF DESIG PREFIX AI

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
AI-1	Cord/Line 3 Conductor Shielded	1	17600	16428	
AI-2	Fuse/SLO-BLO, Miniature, 1 AMP	3	218001	79515	
AI-3	Feet/Nylong	4	FF-009-P4X7	06915	
AI-4	15-Pin, D-Type Connector	1	205206-1	58982	
AI-5	Instruction Manual	1	180873-1	14632	
AI-6	Connector Shell/Hood	1	UG-255/U	80058	

**SECTION IX**  
**SCHEMATIC DIAGRAMS**

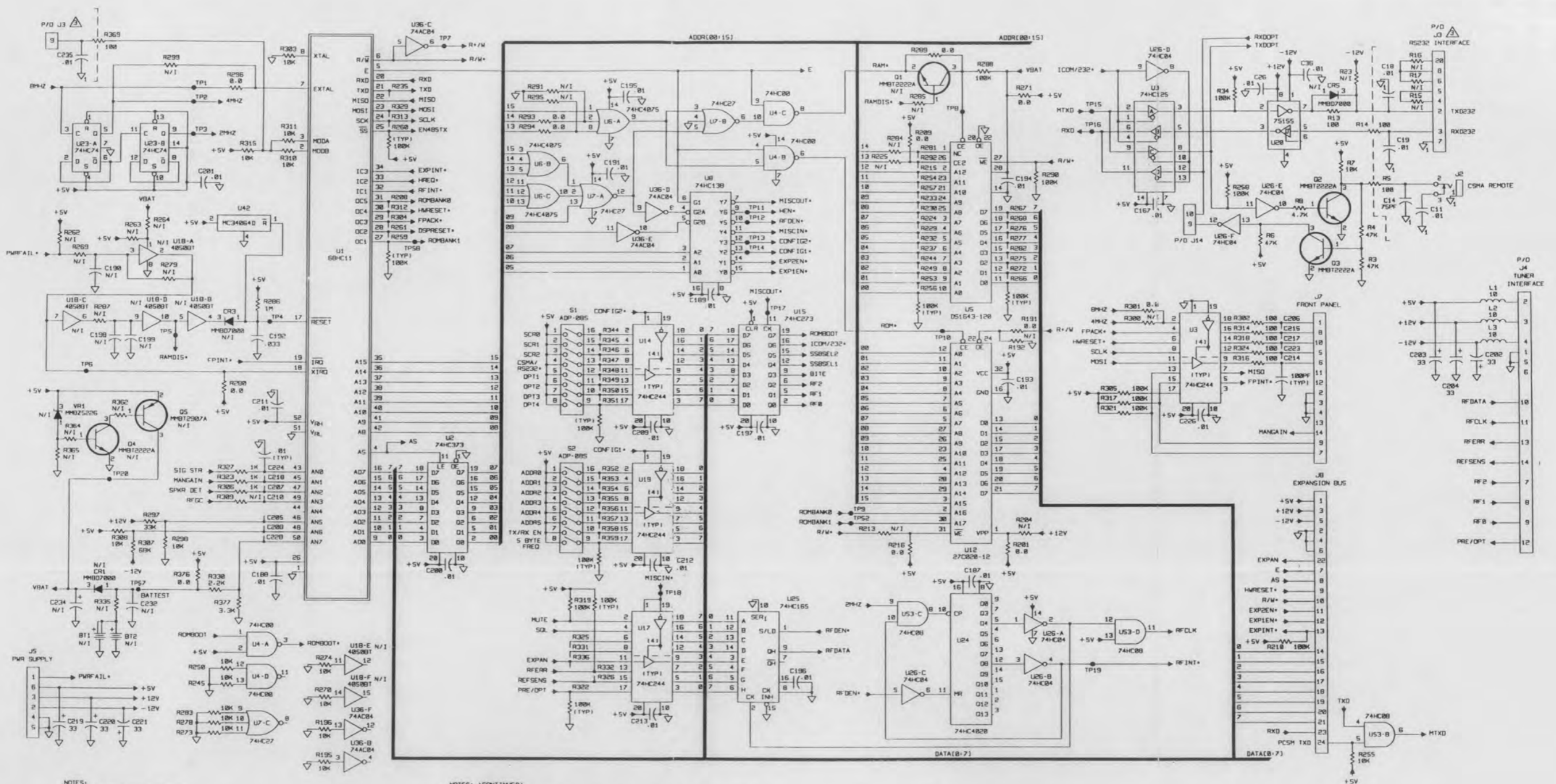


TABLE 1

TYPE	J3	J2
797214-1	USED	USED
797214-2	N/I	USED
797214-3	USED	N/I
797214-4		

NOTES: (CONTINUED)  
 4. IT IS POSSIBLE TO USE VARIOUS DENSITY MEMORY CHIPS FOR U5, U6, U41, U45, U46, U47 & U56. THE FOLLOWING TABLE 2 LISTS EACH ASSY DASH NO. (TYP), IT'S MEMORY CONFIGURATION, AND WHICH 8-DHM RESISTORS MUST BE INSTALLED.

TABLE 2

TYPE	REF DES	DESCRIPTION	PART NO.	R43	R44	R38	R156
797214-1-2	U56	64K X 8 EPROM	27C512				
	U45, U46, U47	32K X 8 SRAM ***	M15C2568	0.0	N/I	0.0	N/I
	U39, U40, U41	32K X 8 SRAM ***	M15C2568				

\*\*\* A 28-PIN 32K X 8 SRAM IS SHOWN ON THE SCHEMATIC. WHEN A 28-PIN 8K X 8 SRAM IS INSTALLED, PIN 26 IS C2 (VS. A13) AND PIN 1 IS NC (VS. 141).

\*\*\* A 32-PIN 128K X 8 SRAM IS SHOWN ON THE SCHEMATIC. WHEN A 28-PIN 32K X 8 IS INSTALLED, PINS 1 THRU 28 CORRESPOND TO PINS 3 THRU 30 ON THE 32-PIN CHIP.

4 - SAME AS -1, EXCEPT CONFORMAL COATED.

Figure 9-1. Type 797214-1 Digital Control Assembly (A2), Schematic Diagram 581839 (Sheet 1 of 4) (B)

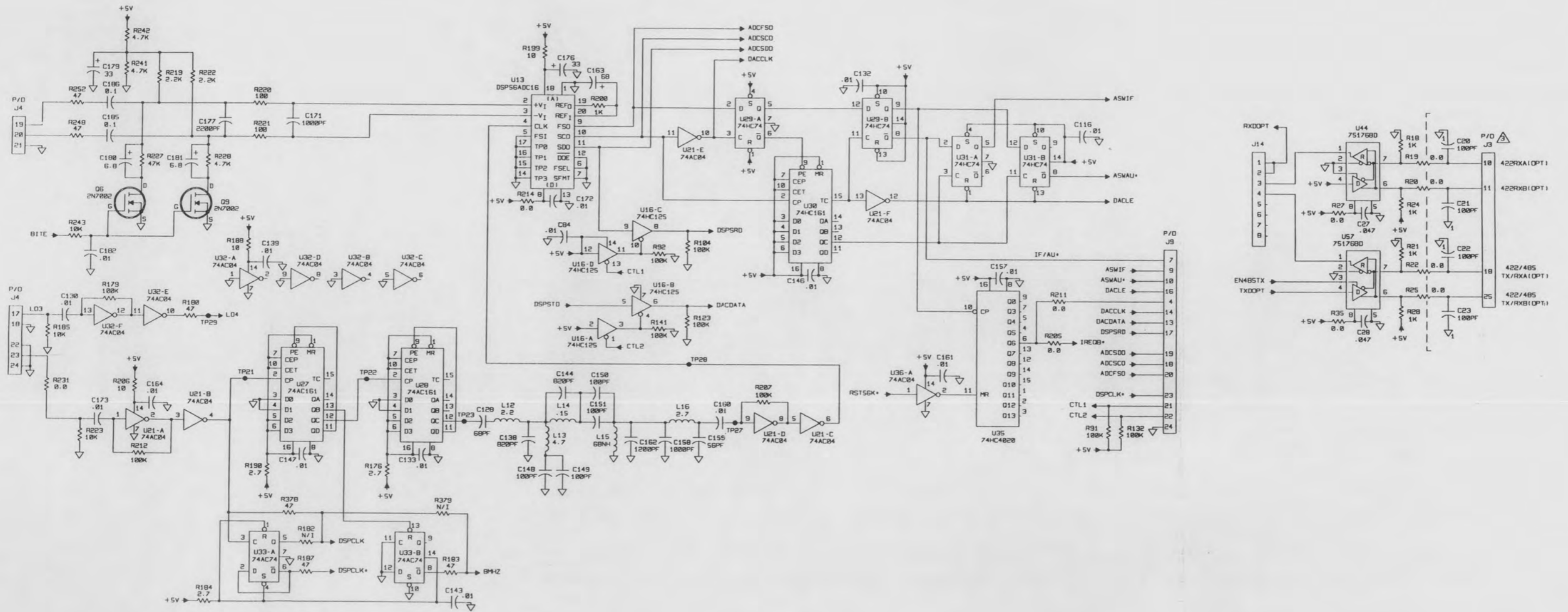


Figure 9-1. Type 797214-1 Digital Control Assembly (A2), Schematic Diagram 581839 (Sheet 2 of 4) (B)  
9-3

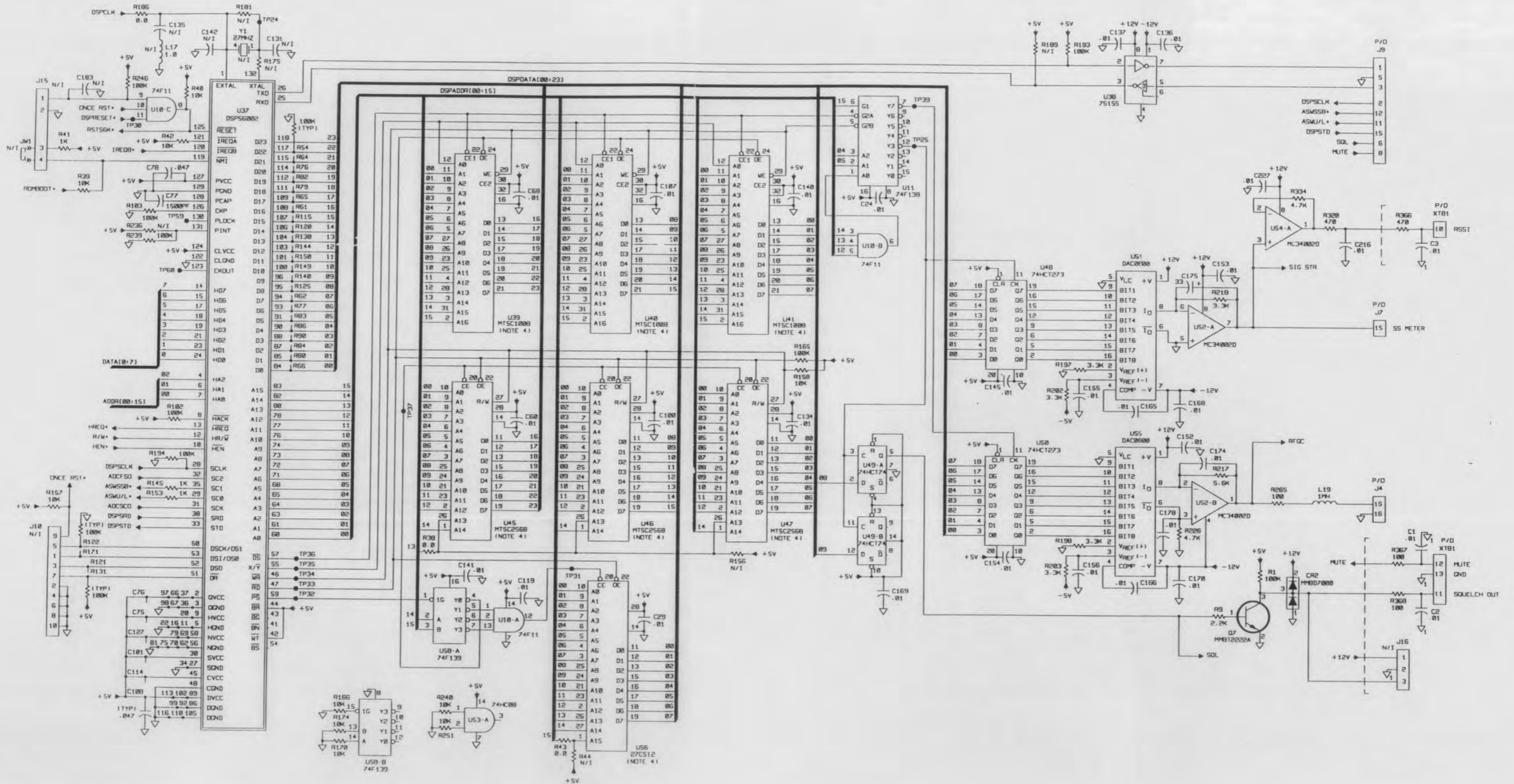


Figure 9-1. Type 797214-1 Digital Control Assembly (A2), Schematic Diagram 581839 (Sheet 3 of 4) (B) 9-5

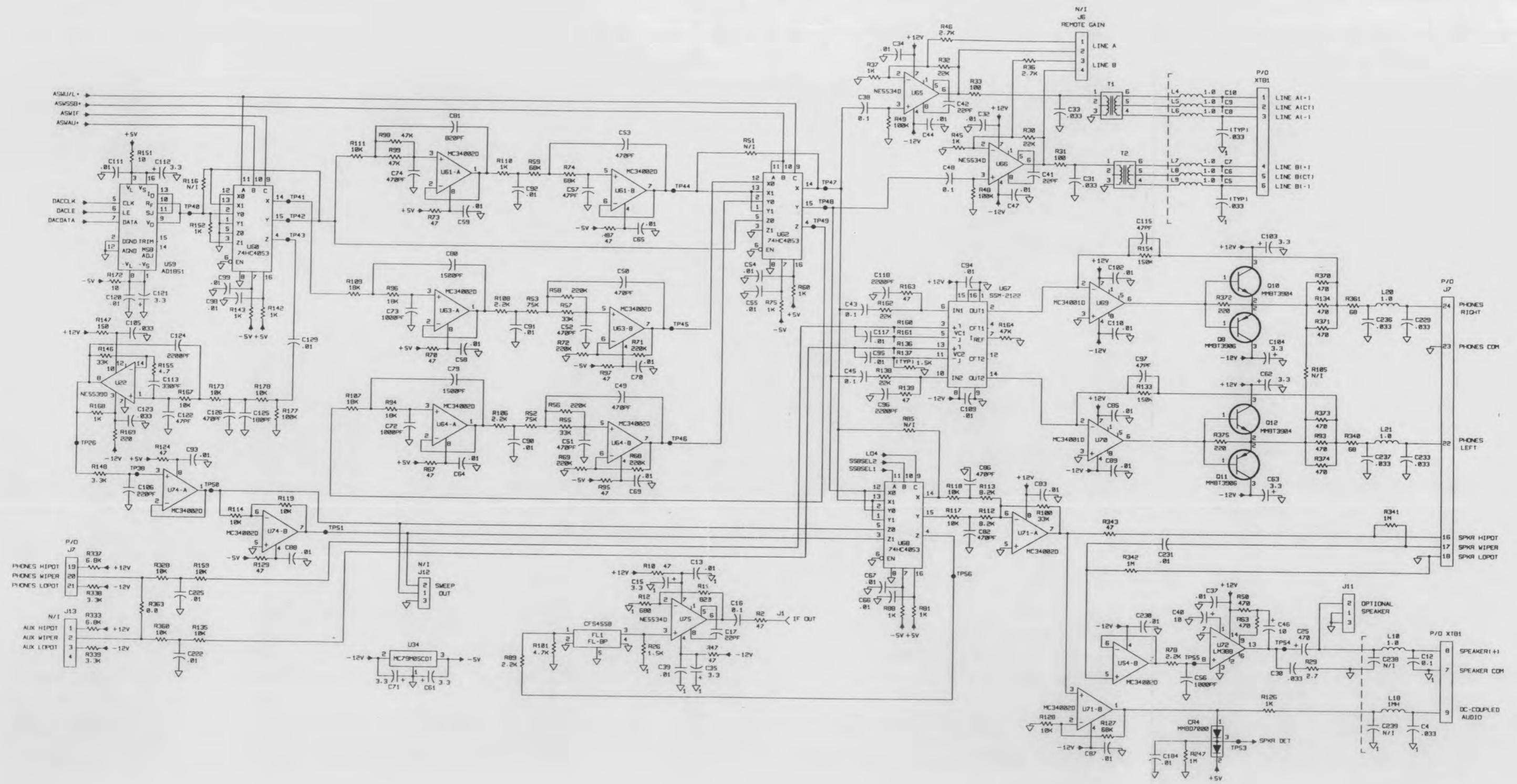
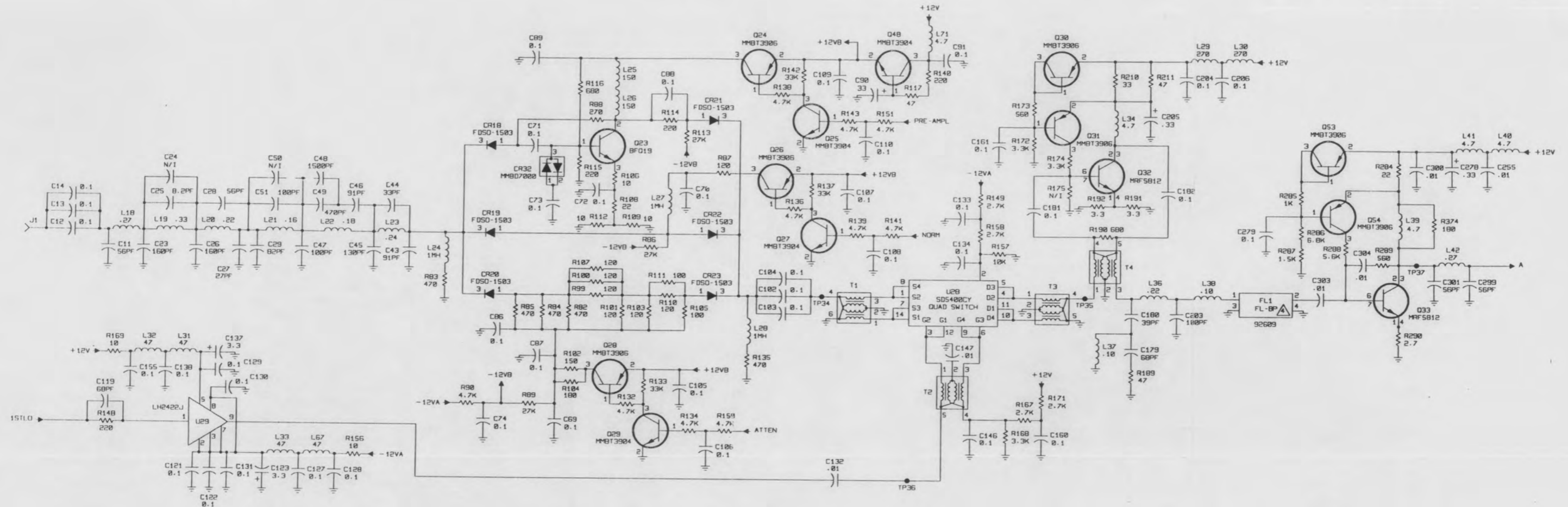


Figure 9-1. Type 797214-1 Digital Control Assembly (A2), Schematic Diagram 581839 (Sheet 4 of 4) (B)





NOTES:

1. UNLESS OTHERWISE SPECIFIED:
  - A) RESISTANCE IS IN OHMS.  $\pm 5\% / 10W$ .
  - B) CAPACITANCE IS IN  $\mu F$ .
  - C) INDUCTANCE IS IN  $\mu H$ .
2. PADDLE-STRIP 'E1' HAS A PLUG LABELED 'P1' (NOT SHOWN) WITH IDENTICAL PINS.
- 3 -3 AND -4 ARE CONFORMAL COATED VERSIONS OF -1 AND -2, RESPECTIVELY.
- 4 SEE TABLE 'A' FOR DIFFERENCE BETWEEN DASH NUMBERS.
- 5 NOMINAL VALUE. FINAL VALUE FACTORY SELECTED.

TABLE A

TYPE/DASH NO.	U9	FL1
797006-1	92658	92609
797006-2	92549	92609
797006-3	3	
797006-4		
797006-5	92698	92699
797006-6	92731	92727
797006-7	92658	92727

Figure 9-2. Type 797006-X RF Tuner Assembly (A3), Schematic Diagram 581274 (Sheet 1 of 3) (M)

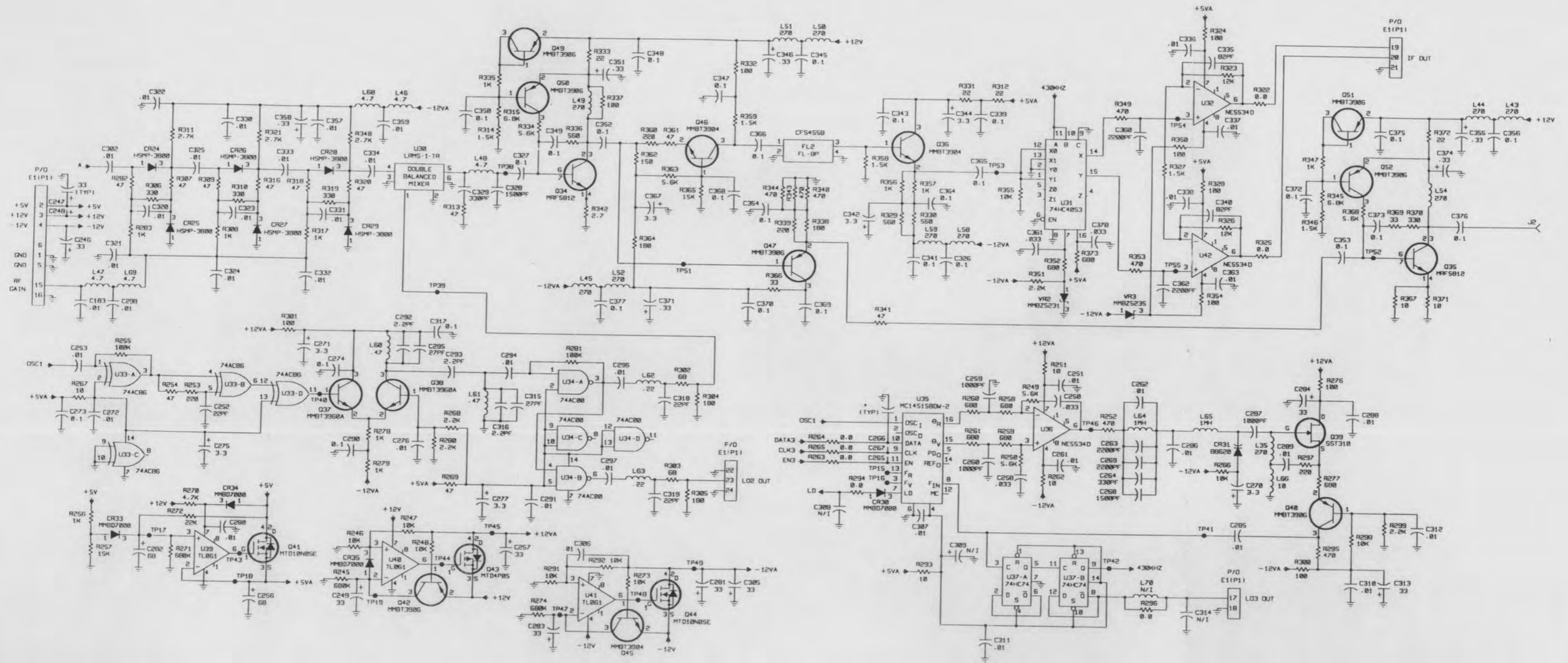


Figure 9-2. Type 797006-X RF Tuner Assembly (A3),  
Schematic Diagram 581274 (Sheet 2 of 3) (R)  
9-11

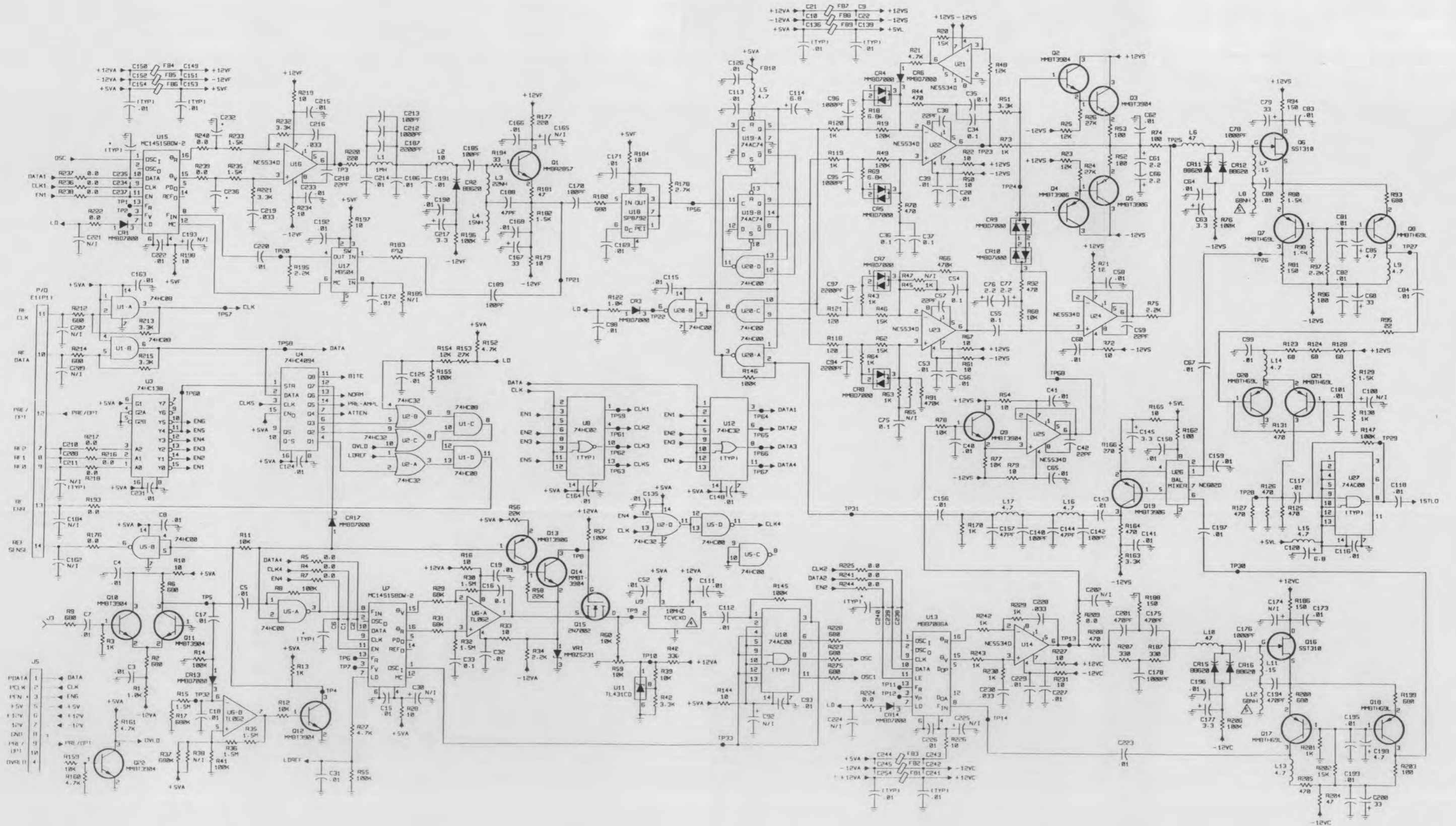


Figure 9-2. Type 797006-X RF Tuner Assembly (A3), Schematic Diagram 581274 (Sheet 3 of 3) (R) 9-13

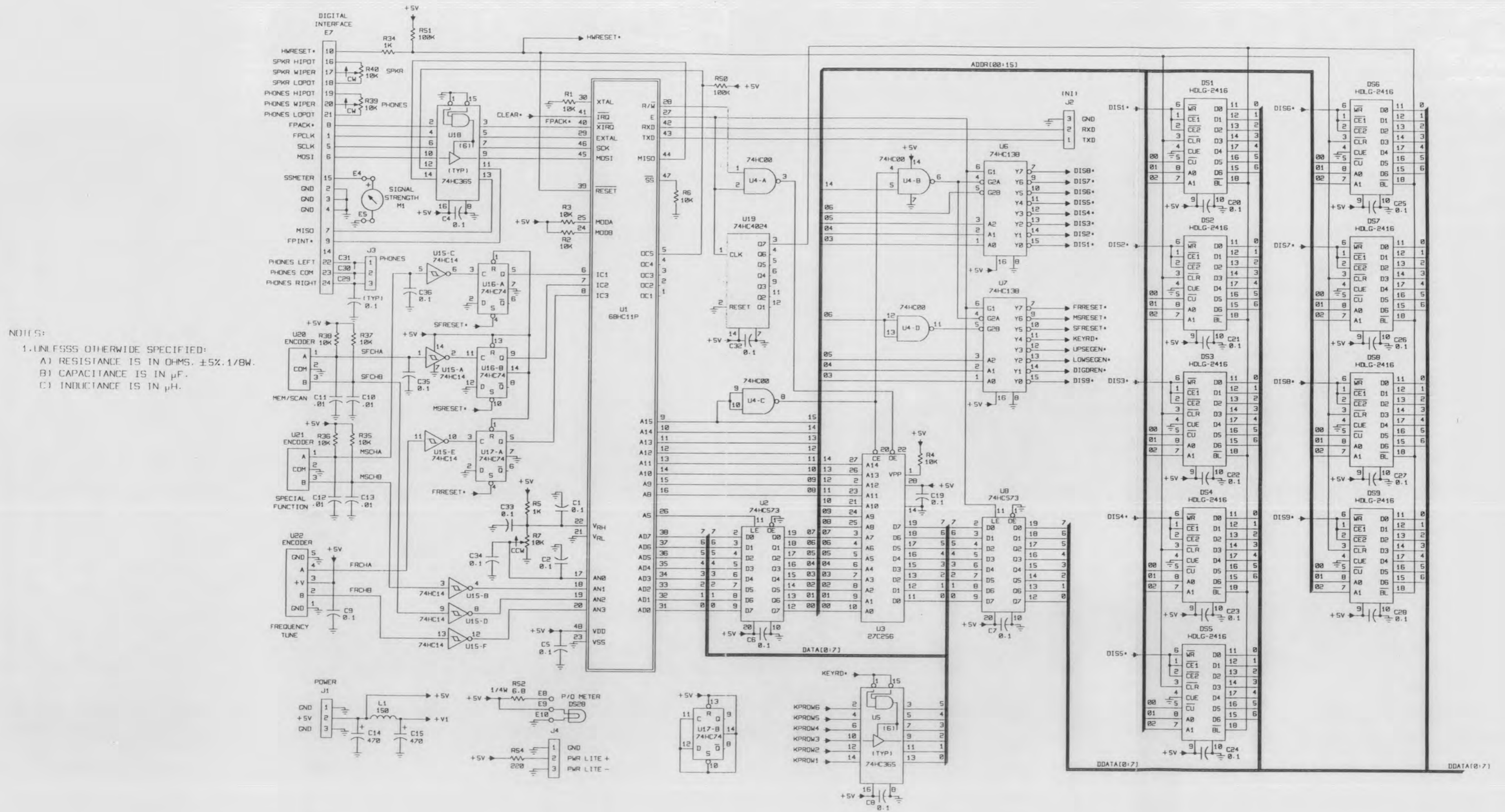


Figure 9-3. Type 482108-1 Front Panel Circuit Card Assembly (A1A1), Schematic Diagram 581267 (Sheet 1 of 2) (D)

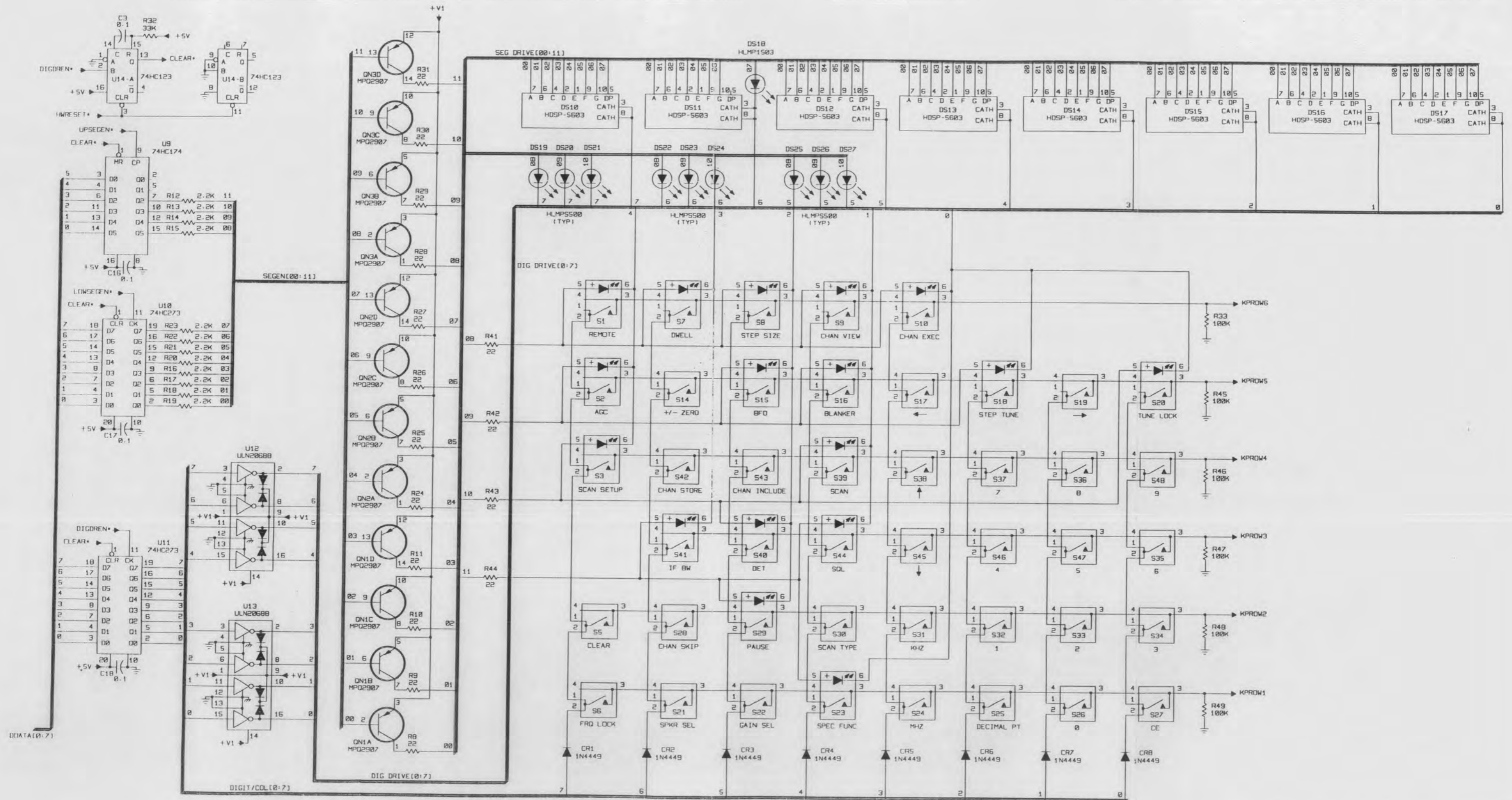


Figure 9-3. Type 482108-1 Front Panel Circuit Card Assembly(A1A1), Schematic Diagram 581267 (Sheet 2 of 2) (D)

HF-1000 DIGITAL HF RECEIVER

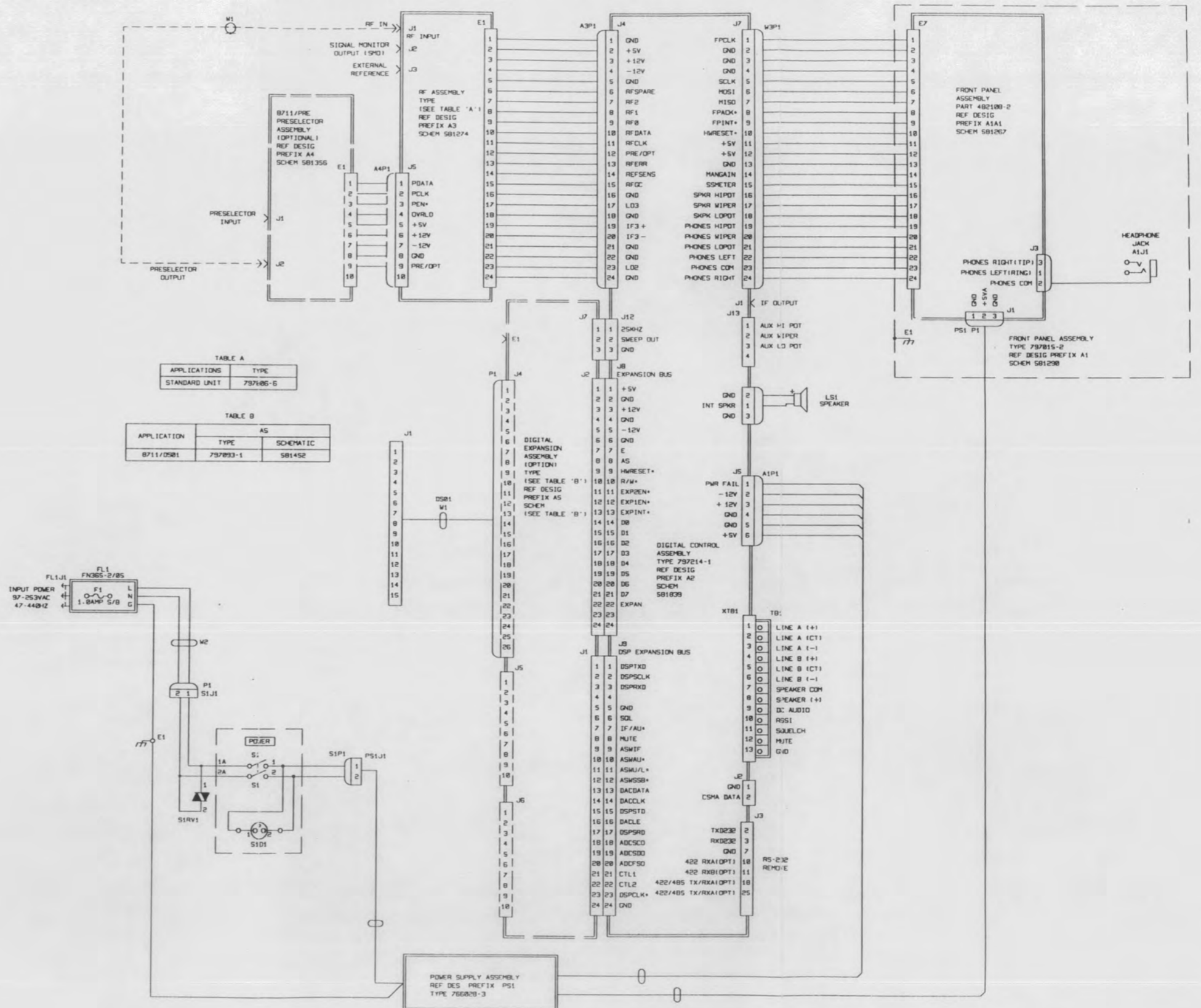


Figure 9-4. HF-1000 Digital HF Receiver, Main Chassis Schematic Diagram 581577 (B)

**APPENDIX A**

**RESERVED FOR A FUTURE OPTION**

**APPENDIX B**

**TYPE WJ-8711/PRE**

**SUBOCTAVE PRESELECTOR OPTION**

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March 1995



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WJ-8711/PRE SUBOCTAVE PRESELECTOR OPTION

REVISION RECORD

**TYPE WJ-8711/PRE SUBOCTAVE PRESELECTOR OPTION**

**REVISION RECORD**

Revision	Description	Date
A	Initial Printing	8/92
B	Updated Parts List.	3/95

**APPENDIX B**

**TYPE WJ-8711/PRE SUBOCTAVE PRESELECTOR OPTION**

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**APPENDIX B**

**TYPE WJ-8711/PRE SUBOCTAVE PRESELECTOR OPTION**

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**APPENDIX B**

**TYPE WJ-8711/PRE SUBOCTAVE PRESELECTOR OPTION**

**B.1 ELECTRICAL CHARACTERISTICS**

The WJ-8711/PRE Suboctave Preselector option filters unwanted out-of-band signal energy from the RF applied to the WJ-8711 Digital HF Receiver. The WJ-8711/PRE option uses eleven preselector bands to improve WJ-8711 second and third order intercept performance. The WJ-8711 digitally selects the appropriate preselector filter based on the receiver's tuned frequency. The WJ-8711/PRE also features two RF overvoltage protection circuits. **Table B-1** lists the WJ-8711/PRE specifications.

**Table B-1. WJ-8711/PRE Suboctave Preselector Option Specifications**

Input Impedance .....	50 ohms, nominal
Output Impedance .....	50 ohms, nominal
Control.....	Digital, via multipin connector to the WJ-8711 tuner board
Second Order Intercept.....	> +60 dBm, typical
Third Order Intercept.....	> +30 dBm, typical
Input VSWR.....	2:1
Input Protection.....	Spark gap, > 1 watt relay threshold
Dimensions .....	6-1/4" x 5-5/8" x 1-5/16"
Operating Temperature Range.....	0°to +50°C
Power Requirements.....	+5 Vdc @ 200mA -12 Vdc @ 2 mA +12 Vdc @ 3 mA

**B.2 MECHANICAL CHARACTERISTICS**

The WJ-8711/PRE Suboctave Preselector option consists of the Type 797033-1 preselector assembly, one BNC cable assembly, and replacement EPROM A2U12. The preselector assembly is housed in an aluminum chassis, which is installed inside the WJ-8711 on its rear panel.

The BNC cable measures six inches and has two male ends. This cable connects the preselector RF output to the WJ-8711 RF input.

EPROM A2U12 contains the internal control software necessary for the WJ-8711 to use the preselector. This chip replaces the current WJ-8711 A2U12 in units containing internal control software releases earlier than 1.40.

**B.3 OVERALL FUNCTIONAL DESCRIPTION**

RF enters the WJ-8711/PRE Suboctave Preselector option at A4J1 and is routed to one of the eleven digitally-selected filters. Table B-2 lists the band, frequency range, insertion loss, 10 dB attenuation points, and type of each of the eleven filters. The RF is filtered and made available at A4J2 for use by the WJ-8711. Spark gap protection at the preselector RF input shunts any voltages of 50 V or greater to ground.

Power sensing at the preselector RF input protects the preselector from RF power levels greater than one watt.

**Table B-2. WJ-8711/PRE Suboctave Preselector Option Filter Information**

Band	Frequency Range (MHz)	Insertion Loss (dB Typ.)	10 dB Attenuation Points (MHz Typ.)	Type
A	25.001 to 30.000000	2.5	18.7 and 36.9	Bandpass
B	20.501 to 25.000999	2.5	15.6 and 30.9	Bandpass
C	14.301 to 20.500999	2.0	8.4 and 30.8	Bandpass
D	9.901 to 14.300999	2.0	5.3 and 21.5	Bandpass
E	6.901 to 9.900999	2.0	3.7 and 14.9	Bandpass
F	4.801 to 6.900999	2.0	2.7 and 10.6	Bandpass
G	3.301 to 4.800999	2.0	1.9 and 7.1	Bandpass
H	2.301 to 3.300999	1.5	1.4 and 5.2	Bandpass
I	1.601 to 2.300999	1.5	0.9 and 3.6	Bandpass
J	0.501 to 1.600999	1.5	2.6	Lowpass
K	0.000 to 0.500999	2.0	0.8	Lowpass

#### B.4

#### EQUIPMENT SUPPLIED

Equipment supplied with the WJ-8711/PRE Suboctave Preselector option consists of:

- 1 WJ-8711/PRE Suboctave Preselector Assembly (Type 797033-1)
- 1 six-inch BNC cable (WJ P/N 383140-1)
- 1 EPROM (A2U12, installed in the WJ-8711 if /PRE ordered with WJ-8711)
- 1 Rear Panel Preselector Decal (mounted on WJ-8711 if /PRE ordered with WJ-8711)
- Mounting hardware consisting of:
  - a. Seven 4-40 x 5/16 large Pan Head Machine screws (WJ P/N MS51957-14)
  - b. Seven No. 4 Flat Washers (WJ P/N MS15795-803)
  - c. Seven No. 4 Lock Washers (WJ P/N MS35338-135)
  - d. Four Standoffs (WJ P/N 20755-293)
  - e. Two Star Washers
  - f. Two BNC Mounting Nuts

**B.5 EQUIPMENT REQUIRED BUT NOT SUPPLIED**

A WJ-8711 Digital HF Receiver and a 50 ohm HF antenna are necessary to obtain full use of the WJ-8711/PRE Suboctave Preselector option.

**B.6 INSTALLATION**

The WJ-8711/PRE Suboctave Preselector option is installed in the WJ-8711 Digital HF Receiver at the factory when ordered with the receiver.

Follow the steps listed in **paragraph B.6.2** when back-fitting the WJ-8711 Digital HF Receiver with the WJ-8711/PRE Suboctave Preselector option.

**B.6.1 CONNECTOR SIGNALS**

When installed, all WJ-8711/PRE option external connectors are located on the rear panel of the WJ-8711. **Table B-3** lists these connectors and provides a brief description of each. **Figure B-1** shows the location of these connectors.

**Table B-3. List of WJ-8711/PRE Option External Connectors**

Connector	Reference Designation	Function
Preselector RF Input	A4J1	BNC female. RF input from antenna.
Preselector RF Output	A4J2	BNC female. Preselected RF output for use by the WJ-8711 RF IN connector (A3J1).

Connector A4P1 contains all the power and control signals necessary for WJ-8711/PRE option operation. **Table B-4** lists the pins, signal names, signal functions, and the signal directions for connector A4P1.

**Table B-4. List of WJ-8711/PRE Option A4P1 Connector Signals**

Pin	Signal	Function	Direction
1	PDAT	Preselector Selection Data	Input
2	PCLK	Preselector Clock	Input
3	PEN-#	Preselector Enable Strobe	Input
4	OVRLD	RF Overload	Output
5	+5 Vdc	+5 Vdc Supply	Input
6	+12 Vdc	+12 Vdc Supply	Input
7	-12 Vdc	-12 Vdc Supply	Input
8	GND	Ground	Input
9	PRE/OPT	Preselector Identification	Output
10	NOT USED		

## B.6.2

**FIELD-INSTALLING THE WJ-8711/PRE OPTION INTO THE WJ-8711**

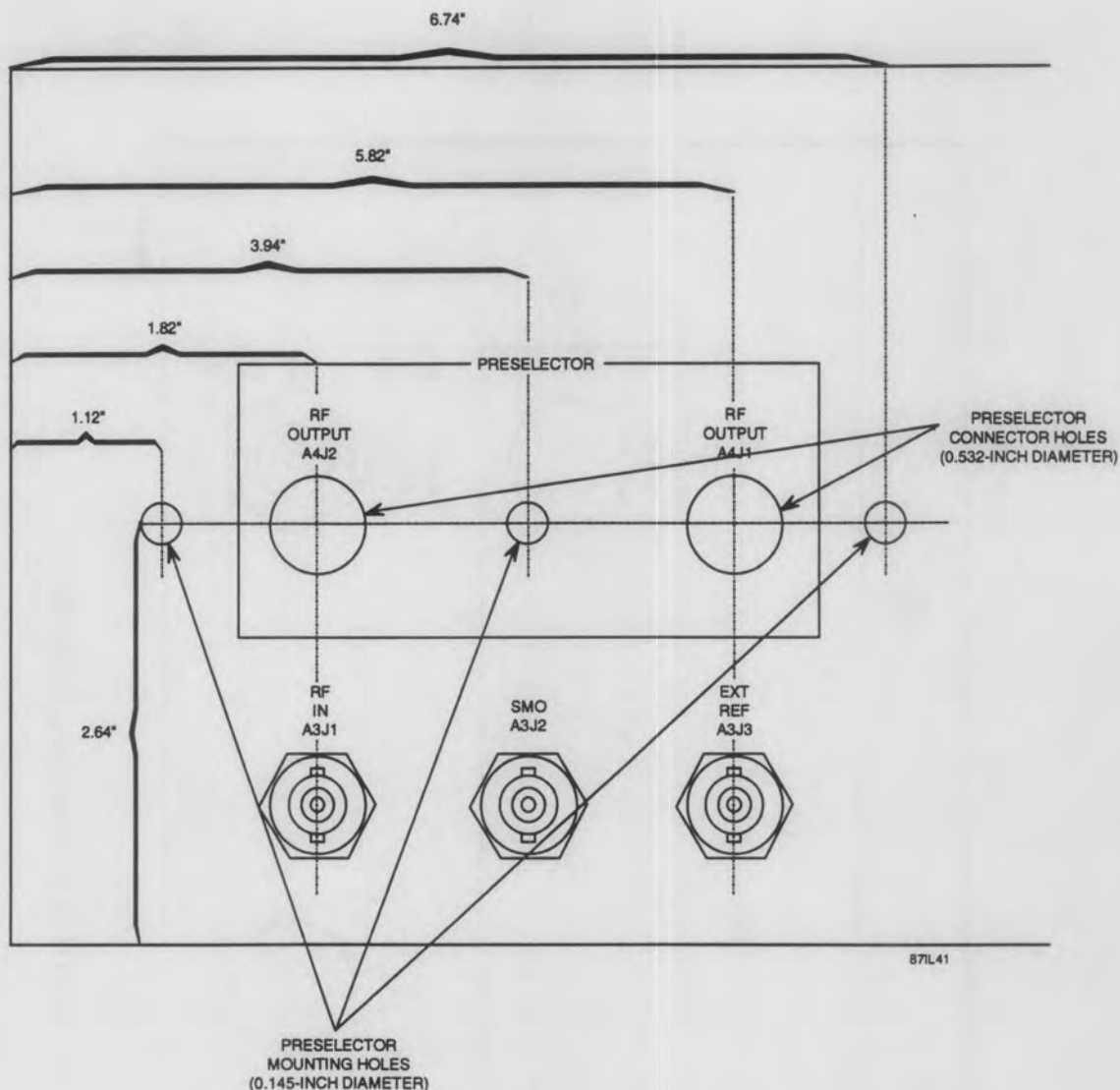
1. Deenergize the WJ-8711 and disconnect the power cord from FL1J1 on the WJ-8711 rear panel.
2. Remove the WJ-8711 top cover.
3. If connected, disconnect the user-provided antenna from the RF IN connector, A3J1, on the WJ-8711 rear panel.
4. WJ-8711s (serial numbers 688 and above) have two 0.532-inch diameter preselector connector holes and three 0.145-inch diameter preselector mounting holes as shown in Figure B-1. Earlier WJ-8711s do not have these holes. If the WJ-8711 does not have these holes, use the information in **Figure B-1**, or the template in **Figure B-2**, to measure and mark the necessary WJ-8711 rear panel.
5. To use the template, photocopy the template. Cut out the five preselector holes, the three BNC holes, and the rear handle hole on the template photocopy. Place the template over the WJ-8711 rear panel (left side) and tape the template in place. Use a 0.532 inch drill bit to drill the two preselector connector holes and a 0.145-inch drill bit to drill the three preselector mounting holes in the WJ-8711 rear panel.

**NOTE**

Take care when drilling both the mounting holes and the connector holes. Ensure that no filings are introduced into the body of the receiver. The metal filings are conductive and can cause equipment malfunctions.

6. Remove the four screws from the RF assembly (A3) marked A, B, C, and D in **Figure B-3**.
7. Replace the four removed screws with the four provided standoffs. Mount each standoff with a lock washer and a flat washer between the standoff and the circuit board.
8. Lower the WJ-8711/PRE Suboctave Preselector assembly onto the standoffs, while ensuring that connectors A4J1 and A4J2 extend through the preselector connector holes (**Figure B-1**). Secure the preselector assembly to the standoffs using four of the provided screws and associated lock washers and flat washers. When installing the screws, ensure that a lock washer and a flat washer is installed between the screw and the preselector assembly.
9. Secure the preselector assembly to the rear panel of the WJ-8711 through the preselector mounting holes (**Figure B-1**) using three of the provided screws and associated lock washers.
10. Secure the preselector RF IN and RF OUT connectors to the WJ-8711 rear panel using the provided two star washers and two BNC mounting nuts.





**Figure B-1. WJ-8711 Rear Panel (Left Side) Showing Locations of Preselector Mounting and Connector Holes**

11. Connect the free end of the preselector assembly-connected ribbon cable to A3J5 located on the Type 796949-1 RF assembly (A3) circuit board. Refer to **Figure B-3** for the location of A3J5.
12. Connect one end of the supplied BNC cable to the RF IN connector, A3J1, located on the WJ-8711 rear panel.
13. Connect the remaining end of the BNC cable to the preselector RF OUTPUT connector, A4J2, located on the WJ-8711 rear panel.
14. Visually check A2U12's software release. Refer to **Figure B-3** for the location of A2U12. If the release is earlier than 1.40, remove A2U12 and install the supplied A2U12 containing the necessary software release. If the release is later than 1.40, no replacement of A2U12 is needed.

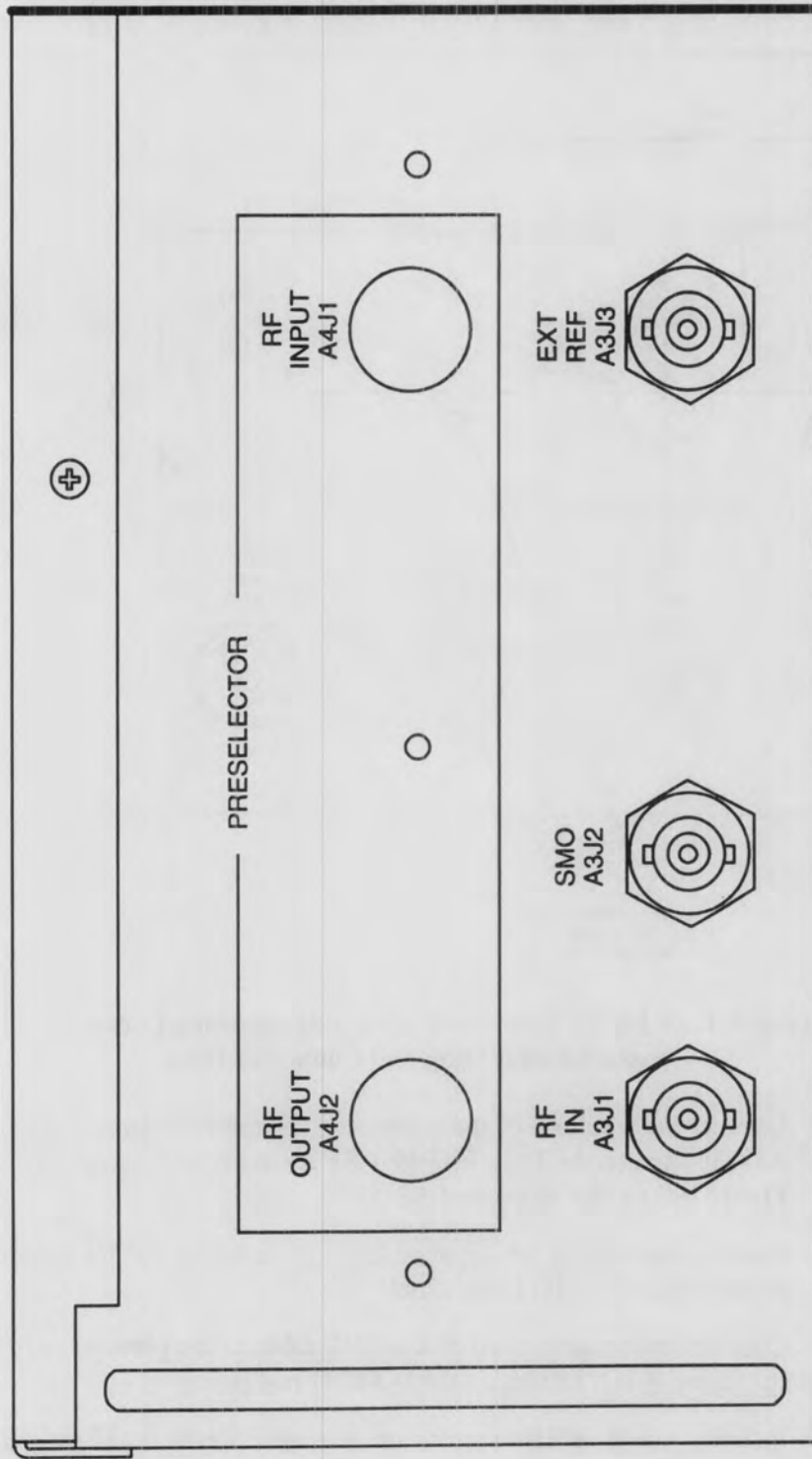
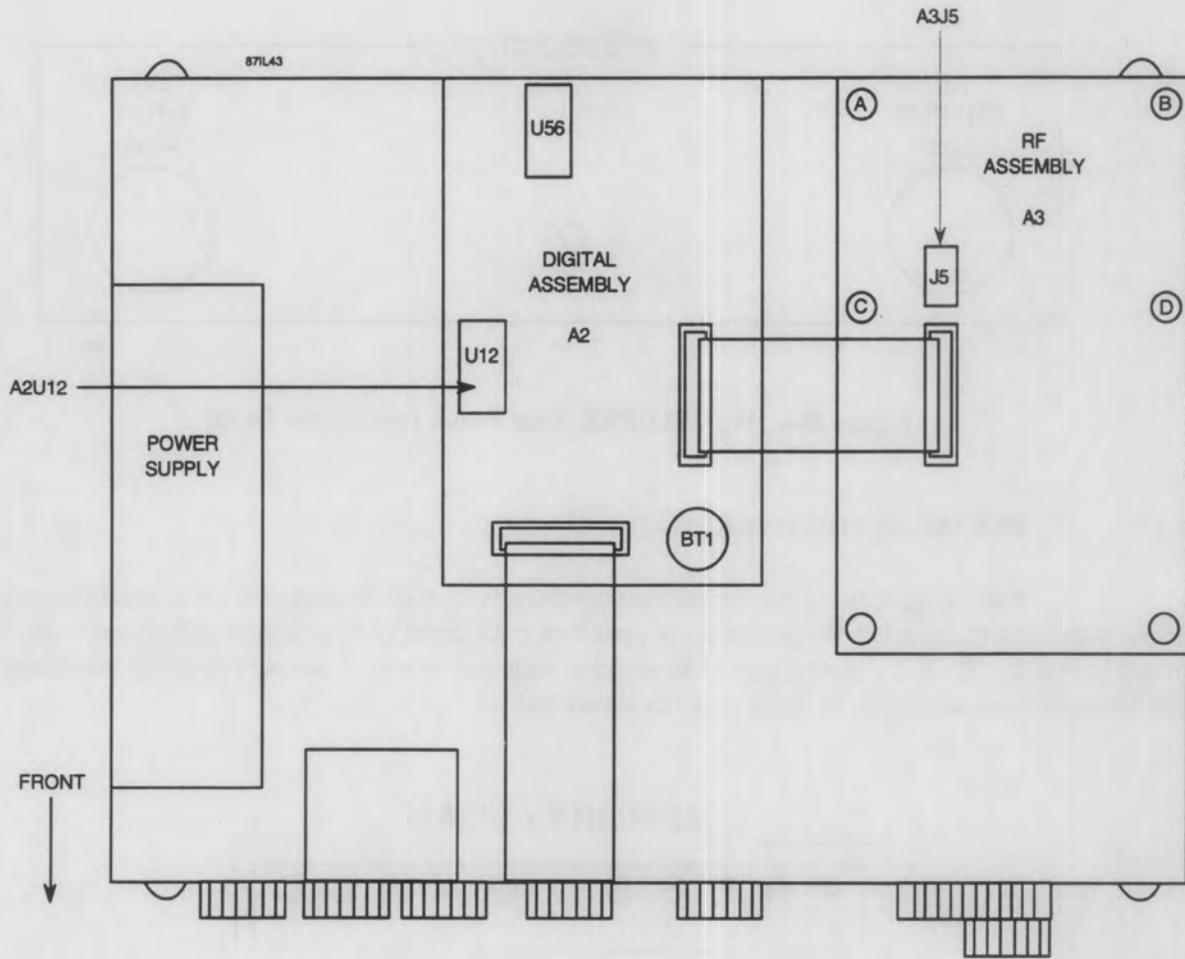


Figure B-2. WJ-8711/PRE Mounting Template



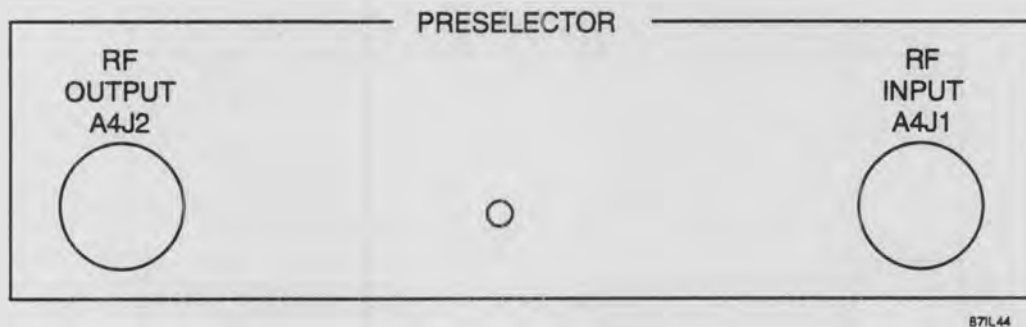
**Figure B-3. WJ-8711 Top Down View (with Cover Removed)  
Showing Locations of A2U12 and A3J5**

15. Replace the WJ-8711 top cover.
16. Affix the Rear Panel Preselector Decal (**Figure B-4**) to the WJ-8711 rear panel as shown in **Figure B-1**.
17. Connect the user-provided antenna to the Preselector RF Input connector, A4J1, located on the WJ-8711 rear panel.
18. Connect the power cord to FL1J1 and energize the WJ-8711.

B.7

**OPERATION**

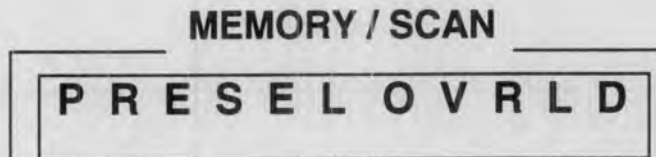
Once installed, WJ-8711 digital control automatically detects and operates the WJ-8711/PRE Suboctave Preselector option.



**Figure B-4. WJ-8711/PRE Rear Panel Preselector Decal**

**B.7.1 PRESELECTOR OVERLOAD**

During operations, the preselector continually checks its input for an overload condition. An overload condition exists when the power at the preselector RF Input (A4J1) is greater than one watt. When an overload exists, the WJ-8711 front panel displays the preselector overload message in the alphanumeric display in the Memory/Scan section of the front panel as shown below:



To reset the preselector overload message, press the CLEAR key, located in the Memory/Scan section of the WJ-8711 front panel.

During the overload, the overload-sensing circuit automatically protects the preselector by removing the applied RF signal from the preselector input. Accordingly, during the overload, the preselector sends no signal to the receiver. A preselector overload condition also sets bit 13 of the Device Dependent Error register. Refer to the base manual for more information on the Device Dependent Error register.

**B.8 REFERENCE DESIGNATION PREFIX**

The use of partial reference designations are used on the equipment and on the manual illustrations. This partial reference designation consists of the component type letter(s) and the identifying component number. The complete reference designation may be obtained by placing the proper prefix before the partial reference designation. Reference designation prefixes are included on the drawings and illustrations in the figure titles (in parenthesis).

**B.9**      **LIST OF MANUFACTURERS**

The manufacturers listed below are supply sources used for obtaining certain parts in the option, and are not listed in the base manual. All other manufacturers not listed below can be found in the base manual.

<u>Mrf. Code</u>	<u>Name and Address</u>	<u>Mrf. Code</u>	<u>Name and Address</u>
00779	AMP, Incorporated 2800 Fulling Mill Road P. O. Box 3608 Middletown, PA 17105-3608	34371	Harris Corporation Semiconductor Sector 200 Palm Bay Blvd. P. O. Box 883 Melbourne, FL 32902-0833
16179	M/A-COM, Inc. M/A-COM Control Components Division 21 Continental Blvd. Merrimack, NH 03054	71482	CP Clare Corporation 3101 W. Pratt Blvd. Chicago, IL 60645-4125
17540	Alpha Industries, Inc. Headquarters Semiconductor Division 20 Sylvan Road P. O. Box 1044 Woburn, MA 01801-1854	95348	Gordos Arkansas, Inc. 1000 N 2nd Street P. O. Box 824 Rogers, AR 72757

**B.10**      **PARTS LIST**

The following parts lists contain all the electrical components used in the unit, along with mechanical parts which may be subject to unusual wear or damage. When ordering replacement parts from the Watkins-Johnson Company, specify the unit type, the serial number, and the option configuration. Also include the reference designation and the description of each item ordered. The list of manufacturers, provided in **paragraph B.9**, and the manufacturer's part number, provided in **paragraph B.10.1**, are supplied as a guide to aid the user of the equipment while in the field. The parts listed may not necessarily be identical with the parts installed in the unit. The parts listed in **paragraph B.10.1** will provide for satisfactory unit operation.

Replacement parts may be obtained from any manufacturer provided that the physical characteristics and electrical parameters of the replacement item are compatible with the original part. In the case where components are defined by a military or industrial specification, a vendor which can provide the necessary component is suggested as a convenience to the user.

**NOTE**

As improvements in semiconductors are made, it is the policy of Watkins-Johnson to incorporate them in proprietary products. As a result, some transistors, diodes and integrated circuits which are installed in the unit may not agree with the parts lists or schematic diagrams of this manual. However, semiconductor devices listed in this manual may be substituted with satisfactory results.

REPLACEMENT PARTS LIST

WJ-8711/PRE SUBOCTAVE PRESELECTOR OPTION

B.10.1 TYPE 8711/PRE PRESELECTOR OPTION

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
A4	Preselector Assembly	1	797033-1	14632	
	Resistor, Valriable, 10 KB Side Adjust Potentiometer	1	3269X-1-103	80294	
A4A1	Preselector PC Assy	1	482202-1	14632	

WJ-8711/PRE SUBOCTAVE PRESELECTION OPTION

REPLACEMENT PARTS LIST

B.10.1.1 Type 482202-1 Preselector PC Assy

REF DESIG PREFIX A4A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
	Revision C1				
E1	Cable Assembly 10 POS M-4 IN LG GRAY 28AWG	1	IDMD-5-T-4-C-G	55322	
C1	Capacitor, Ceramic, .047 $\mu$ F $\pm$ 10%, 50V 0805	41	841415-023	14632	
C2	Capacitor, Tantalum, 10 $\mu$ F $\pm$ 20%, 35V	3	841293-17	14632	
C3					
Thru	Not Used				
C6					
C7	Capacitor, Tantalum, 68 $\mu$ F $\pm$ 20%, 6.3V	2	841293-24	14632	
C8	Not Used				
C9	Not Used				
C10	Capacitor, Ceramic, 51pF $\pm$ 2%, 50V 0805	2	841416-042	14632	
C11	Not Used				
C12	Not Used				
C13	Capacitor, Ceramic, 100pF $\pm$ 2%, 50V 0805	10	841416-049	14632	
C14	Capacitor, Ceramic, 6.2pF $\pm$ .25pF 50V 0805	1	841416-020	14632	
C15	Not Used				
C16	Not Used				
C17	Same as C10				
C18					
Thru	Not Used				
C20					
C21	Same as C1				
C22	Capacitor, Ceramic, 33pF $\pm$ 2%, 50V 0805	6	841416-037	14632	
C23	Capacitor, Ceramic, 6.8pF $\pm$ .25pF 50V 0805	7	841416-021	14632	
C24	Capacitor, Ceramic, 12pF $\pm$ 2%, 50V 0805	5	841416-027	14632	
C25	Same as C23				
C26	Capacitor, Ceramic, 22pF $\pm$ 2%, 50V 0805	5	841416-033	14632	
C27	Same as C1				
C28	Capacitor, Ceramic, 3.3pF $\pm$ .1pF 50V 0805	1	841416-013	14632	
C29	Same as C24				
C30	Capacitor, Ceramic, 4.7pF $\pm$ .1pF 50V 0805	1	841416-017	14632	
C31	Not Used				
C32	Same as C22				
C33	Capacitor, Tantalum, 6.8 $\mu$ F $\pm$ 20%, 6.3V	10	841293-14	14632	
C34	Not Used				
C35	Not Used				
C36	Same as C1				
C37	Capacitor, Ceramic, 39pF $\pm$ 2%, 50V 0805	4	841416-039	14632	
C38	Capacitor, Ceramic, 8.2pF $\pm$ .25pF 50V 0805	3	841416-023	14632	
C39	Same as C1				
C40	Capacitor, Ceramic, 56pF $\pm$ 2%, 50V 0805	5	841416-043	14632	
C41	Same as C23				
C42	Same as C26				
C43	Same as C23				
C44	Capacitor, Ceramic, 27pF $\pm$ 2%, 50V 0805	6	841416-035	14632	

REPLACEMENT PARTS LIST

WJ-8711/PRE SUBOCTAVE PRESELECTOR OPTION

REF DESIG PREFIX A4A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C45	Same as C38				
C46	Same as C26				
C47	Same as C23				
C48	Same as C1				
C49	Same as C33				
C50	Same as C23				
C51	Same as C40				
C52	Same as C38				
C53	Same as C37				
C54	Same as C1				
C55	Same as C26				
C56	Capacitor, Ceramic, 5.1pF $\pm$ .25pF 50V	2	841416-018	14632	
C57	Same as C1				
C58	Capacitor, Ceramic, 68pF $\pm$ 2%, 50V 0805	5	841416-045	14632	
C59	Same as C24				
C60	Same as C13				
C61	Same as C44				
C62	Capacitor, Ceramic, 62pF $\pm$ 2%, 50V 0805	5	841416-044	14632	
C63	Same as C23				
C64	Same as C13				
C65	Same as C44				
C66	Same as C24				
C67	Same as C58				
C68	Same as C1				
C69	Same as C33				
C70	Same as C56				
C71	Same as C26				
C72	Same as C1				
C73	Same as C13				
C74	Capacitor, Ceramic, 18pF $\pm$ 2%, 50V 0805	3	841416-031	14632	
C75	Same as C1				
C76	Capacitor, Ceramic, 150pF $\pm$ 2%, 50V 0805	6	841416-053	14632	
C77	Same as C44				
C78	Capacitor, Ceramic, 270pF $\pm$ 2%, 50V 0805	7	841416-059	14632	
C79	Capacitor, Ceramic, 47pF $\pm$ 2%, 50V 0805	8	841416-041	14632	
C80	Same as C1				
C81	Same as C58				
C82	Same as C24				
C83	Same as C79				
C84	Same as C78				
C85	Same as C44				
C86	Same as C33				
C87	Same as C76				
C88	Same as C74				
C89	Same as C13				



WJ-8711/PRE SUBOCTAVE PRESELECTION OPTION

REPLACEMENT PARTS LIST

REF DESIG PREFIX A4A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C90	Same as C1				
C91	Same as C76				
C92	Same as C22				
C93	Same as C1				
C94	Capacitor, Ceramic, 220pF $\pm 2\%$ , 50V 0805	6	841416-057	14632	
C95	Same as C79				
C96	Capacitor, Ceramic, 330pF $\pm 2\%$ , 50V 0805	4	841416-061	14632	
C97	Capacitor, Ceramic, 82pF $\pm 2\%$ , 50V 0805	5	841416-047	14632	
C98	Same as C97				
C99	Same as C1				
C100	Same as C74				
C101	Same as C96				
C102	Same as C97				
C103	Same as C79				
C104	Same as C33				
C105	Same as C94				
C106	Same as C22				
C107	Same as C76				
C108	Same as C1				
C109	Capacitor, Ceramic, 180pF $\pm 2\%$ , 50V 0805	5	841416-055	14632	
C110	Same as C37				
C111	Same as C1				
C112	Same as C78				
C113	Same as C62				
C114	Capacitor, Ceramic, 470pF $\pm 2\%$ , 50V 0805	6	841416-065	14632	
C115	Same as C62				
C116	Same as C76				
C117	Same as C44				
C118	Same as C1				
C119	Same as C33				
C120	Same as C114				
C121	Same as C62				
C122	Same as C62				
C123	Same as C78				
C124	Same as C37				
C125	Same as C76				
C126	Same as C1				
C127	Same as C94				
C128	Same as C1				
C129	Same as C22				
C130	Same as C96				
C131	Same as C97				
C132	Same as C1				
C133	Capacitor, Ceramic, 680pF $\pm 2\%$ , 50V 0805	4	841416-069	14632	
C134	Same as C79				

REPLACEMENT PARTS LIST

WJ-8711/PRE SUBOCTAVE PRESELECTOR OPTION

REF DESIG PREFIX A4A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C135	Same as C78				
C136	Same as C79				
C137	Same as C133				
C138	Same as C79				
C139	Same as C97				
C140	Same as C33				
C141	Same as C96				
C142	Same as C22				
C143	Same as C94				
C144	Same as C1				
C145	Same as C78				
C146	Same as C58				
C147	Same as C1				
C148	Same as C114				
C149	Same as C13				
C150	Same as C1				
C151	Same as C1				
C152	Not Used				
C153	Not Used				
C154	Capacitor, Ceramic, 560pF $\pm 2\%$ , 50V 0805	1	841416-067	14632	
C155	Capacitor, Ceramic, 1000pF $\pm 2\%$ , 50V 0805	1	841416-073	14632	
C156	Same as C13				
C157	Same as C1				
C158	Same as C7				
C159	Same as C1				
C160	Capacitor, Ceramic, 820pF $\pm 2\%$ , 50V 0805	4	841416-071	14632	
C161	Capacitor, Ceramic, 120pF $\pm 2\%$ , 50V 0805	2	841416-051	14632	
C162	Capacitor, Ceramic, 390pF $\pm 2\%$ , 50V 0805	1	841416-063	14632	
C163	Same as C40				
C164	Same as C33				
C165	Same as C160				
C166	Same as C161				
C167	Same as C13				
C168	Same as C114				
C169	Same as C58				
C170	Same as C78				
C171	Same as C1				
C172	Same as C40				
C173	Same as C114				
C174	Same as C1				
C175	Same as C109				
C176	Same as C133				
C177	Same as C109				
C178	Capacitor, Ceramic, 1200pF $\pm 2\%$ , 50V 0805	4	841416-075	14632	
C179	Same as C79				

WJ-8711/PRE SUBOCTAVE PRESELECTION OPTION

REPLACEMENT PARTS LIST

REF DESIG PREFIX A4A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C180	Same as C1				
C181	Same as C109				
C182	Same as C178				
C183	Same as C33				
C184	Same as C109				
C185	Same as C133				
C186	Same as C114				
C187	Same as C40				
C188	Same as C94				
C189	Same as C1				
C190	Capacitor, Ceramic, .015 $\mu$ F $\pm$ 10%, 50V 0805	1	841415-020	14632	
C191	Same as C160				
C192	Capacitor, Ceramic, 1500pF $\pm$ 2%, 50V 0805	4	841416-077	14632	
C193	Same as C1				
C194	Same as C178				
C195	Same as C33				
C196	Same as C178				
C197	Same as C192				
C198	Same as C94				
C199	Same as C160				
C200	Same as C1				
C201	Capacitor, Ceramic, 2700pF $\pm$ 2%, 50 WV OR L3	2	841314-083	14632	
C202	Same as C201				
C203	Not Used				
C204	Not Used				
C205	Same as C2				
C206	Same as C192				
C207	Capacitor, Ceramic, 4700pF $\pm$ 2%, 50 WV OR S3	2	841314-089	14632	
C208	Same as C192				
C209	Same as C207				
C210	Not Used				
C211	Not Used				
C212	Same as C1				
C213	Same as C1				
C214	Not Used				
C215	Not Used				
C216	Same as C2				
C217					
Thru	Not Used				
C223					
C224	Same as C217				
C225	Same as C1				
C226	Capacitor, Tantalum, 4.7 $\mu$ F $\pm$ 20%, 20V	4	841293-25	14632	
C227	Same as C226				
C228	Same as C1				

REPLACEMENT PARTS LIST

WJ-8711/PRE SUBOCTAVE PRESELECTOR OPTION

REF DESIG PREFIX A4A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C229	Same as C226				
C230	Same as C226				
C231	Same as C13				
C232	Same as C13				
C233	Same as C1				
C234					
Thru	Not Used				
C237					
C238					
Thru	Same as C1				
C240					
CR1	Not Used				
CR2	Diode/SWPIN Dual Switching Diode Reverse Voltage	2	MMBD7000LT1	04713	
CR3	OBS; Diode Use CN 630294; General Purpose 100=V 25NA@20V	2	MMBD1203-HIGH	27014	
CR4	Same as CR3				
CR5	Diode VBR=300V RS=>10HM @ 100 MILLIGRAMS	20	SMP1300-99	17540	
CR6					
Thru	Same as CR5				
CR24					
CR25	Not Used				
CR26	Same as CR2				
CR27	Not Used				
CR28	Not Used				
CR29	Diode/PIN RS=0.5 C=2.2 TAU=6.0US POWER=7.5W	2	MA4P4001F	16179	
CR30	Same as CR29				
J1	Connector, Jack, BNC BNC RT ANG PCB/PANEL MT W/SLDR MT POSTS	2	227677-1	00779	
J2	Same as J1				
J3	Not Used				
J4	Not Used				
JW1	Jumper .05 W MAX 1A MIN@70C	5	841417	14632	
JW2					
Thru	Same as JW1				
JW5					
K1	RELAY REED NOM COIL VOLT 5 COIL RES 380W ±10%, (MFR	1	SMJ1A05-S	95348	
L1	Not Used				
L2	Inductor, 220nH ±5%, Qmin-50@100MHz >550MHz= SRF .10W=R	2	841438-033	14632	
L3	Same as L2				
L4	Inductor, 680nH ±5%, Qmin-50@25MHz >150MHz= SRF .30W=RD	9	841438-045	14632	
L5	Same as L4				
L6	Same as L4				

WJ-8711/PRE SUBOCTAVE PRESELECTION OPTION

REPLACEMENT PARTS LIST

REF DESIG PREFIX A4A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
L7	Inductor, 330mH $\pm 5\%$ , Qmin-40@.79MHz 3.5MHz= SRF 14W=DCR 85	20	841444-061	14632	
L8	Same as L7				
L9	Same as L7				
L10					
Thru	Same as L4				
L12					
L13	Same as L7				
L14	Same as L7				
L15	Inductor, 560nH $\pm 5\%$ , Qmin-50@25MHz >190MHz= SRF .26W=RD	3	841438-043	14632	
L16	Same as L15				
L17	Same as L15				
L18	Same as L7				
L19	Same as L7				
L20					
Thru	Same as L4				
L22					
L23	Same as L7				
L24	Same as L7				
L25	Inductor, 1.0mH $\pm 5\%$ , Qmin-50@7.9MHz 100MHz= SRF .50W=DCR 6	3	841444-001	14632	
L26	Same as L25				
L27	Same as L25				
L28	Same as L7				
L29	Same as L7				
L30	Inductor, 1.5 $\mu$ H $\pm 5\%$ , Qmin-50@7.9MHz 70MHz= SRF .60W=DCR 50	3	841444-005	14632	
L31	Same as L30				
L32	Same as L30				
L33	Same as L7				
L34	Same as L7				
L35	Inductor, 2.2 $\mu$ H $\pm 5\%$ , Qmin-50@7.9MHz 55MHz= SRF .70W=DCR 48	3	841444-009	14632	
L36	Same as L35				
L37	Same as L35				
L38	Same as L7				
L39	Same as L7				
L40	Inductor, 3.3 $\mu$ H $\pm 5\%$ , Qmin-50@7.9MHz 45MHz= SRF .80W=DCR 46	3	841444-013	14632	
L41	Same as L40				
L42	Same as L40				
L43	Same as L7				
L44	Same as L7				

## REPLACEMENT PARTS LIST

## WJ-8711/PRE SUBOCTAVE PRESELECTOR OPTION

## REF DESIG PREFIX A4A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
L45	Inductor, 4.7 $\mu$ H $\pm$ 5%, Qmin-50@7.9MHz 35MHz= SRF 1.00W=DCR 4	3	841444-017	14632	
L46	Same as L45				
L47	Same as L45				
L48	Same as L7				
L49	Same as L7				
L50	Inductor, 5600nH $\pm$ 5%, Qmin-35@7.9MHz >39MHz= SRF 2.1W=R	2	841438-067	14632	
L51	Inductor, 6800nH $\pm$ 5%, Qmin-35@7.9MHz >31MHz= SRF .27W=R	1	841438-069	14632	
L52	Same as L50				
L53	Same as L7				
L54	Inductor, 680 $\mu$ H $\pm$ 5%, Qmin-30@.79MHz 3.0MHz= SRF 30W=DCR 60	5	841444-069	14632	
L55	Same as L54				
L56	Inductor, 12 $\mu$ H Q=45 F=2.5M FR=40M R=2.7 I=16OMA IRON CORE	2	1330-46	99800	
L57	Inductor, 27 $\mu$ H Q=45 F=2.5M FR=20M R=3.5 I=14OMA IRON CORE	1	1330-54	99800	
L58	Same as L56				
L59	Same as L54				
L60	Same as L54				
L61	Inductor, 47 $\mu$ H $\pm$ 5%, Qmin-50@2.5MHz 10MHz= SRF 5.0W=DCR 160	1	841444-041	14632	
L62	Not Used				
Thru L65					
L66	Same as L54				
Q1	Transistor	2	MMBT3904LT1	04713	
Q2	Same as Q1				
Q3	Transistor	11	MMBT2907ALT1	04713	
Q4					
Thru Q13	Same as Q3				
Q14	Transistor	1	MTD10N05E	04713	
R1	Resistor, Fixed, 3.9k $\Omega$ $\pm$ 5%, .1W 0805	1	841414-087	14632	
R2	Resistor, Fixed, 1.0k $\Omega$ $\pm$ 5%, .1W 0805	8	841414-073	14632	
R3	Resistor, Fixed, 10k $\Omega$ $\pm$ 5%, .1W 0805	13	841414-097	14632	
R4	Same as R3				
R5	Resistor, Fixed, 10 $\Omega$ $\pm$ 5%, .1W 0805	23	841414-025	14632	
R6	Same as R5				
R7	Same as R3				
R8	Resistor, Fixed, 330 $\Omega$ $\pm$ 5%, .1W 0805	15	841414-061	14632	
R9	Same as R5				
R10	Same as R5				

WJ-8711/PRE SUBOCTAVE PRESELECTION OPTION

REPLACEMENT PARTS LIST

REF DESIG PREFIX A4A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R11	Same as R3				
R12	Same as R8				
R13	Same as R5				
R14	Same as R3				
R15	Same as R5				
R16	Same as R8				
R17	Same as R5				
R18	Same as R3				
R19	Same as R5				
R20	Same as R8				
R21	Same as R5				
R22	Same as R3				
R23	Same as R8				
R24	Same as R5				
R25	Same as R5				
R26	Same as R3				
R27	Same as R5				
R28	Same as R8				
R29	Same as R5				
R30	Same as R3				
R31	Same as R5				
R32	Same as R8				
R33	Same as R5				
R34	Same as R3				
R35	Same as R8				
R36	Same as R5				
R37	Same as R3				
R38	Same as R5				
R39	Same as R8				
R40	Same as R5				
R41	Same as R5				
R42	Same as R3				
R43	Same as R5				
R44	Same as R8				
R45	Not Used				
R46	Same as R2				
R47	Same as R2				
R48	Resistor, Fixed, 15kΩ ±5%, .1W 0805	1	841414-101	14632	
R49	Resistor, Fixed, 680kΩ ±5%, .1W 0805	1	841414-141	14632	
R50	Resistor, Fixed, 22kΩ ±5%, .1W 0805	1	841414-105	14632	
R51	Resistor, Fixed, 4.7kΩ ±5%, .1W 0805	1	841414-089	14632	
R52	Same as R5				
R53	Same as R3				
R54	Same as R5				
R55	Same as R8				

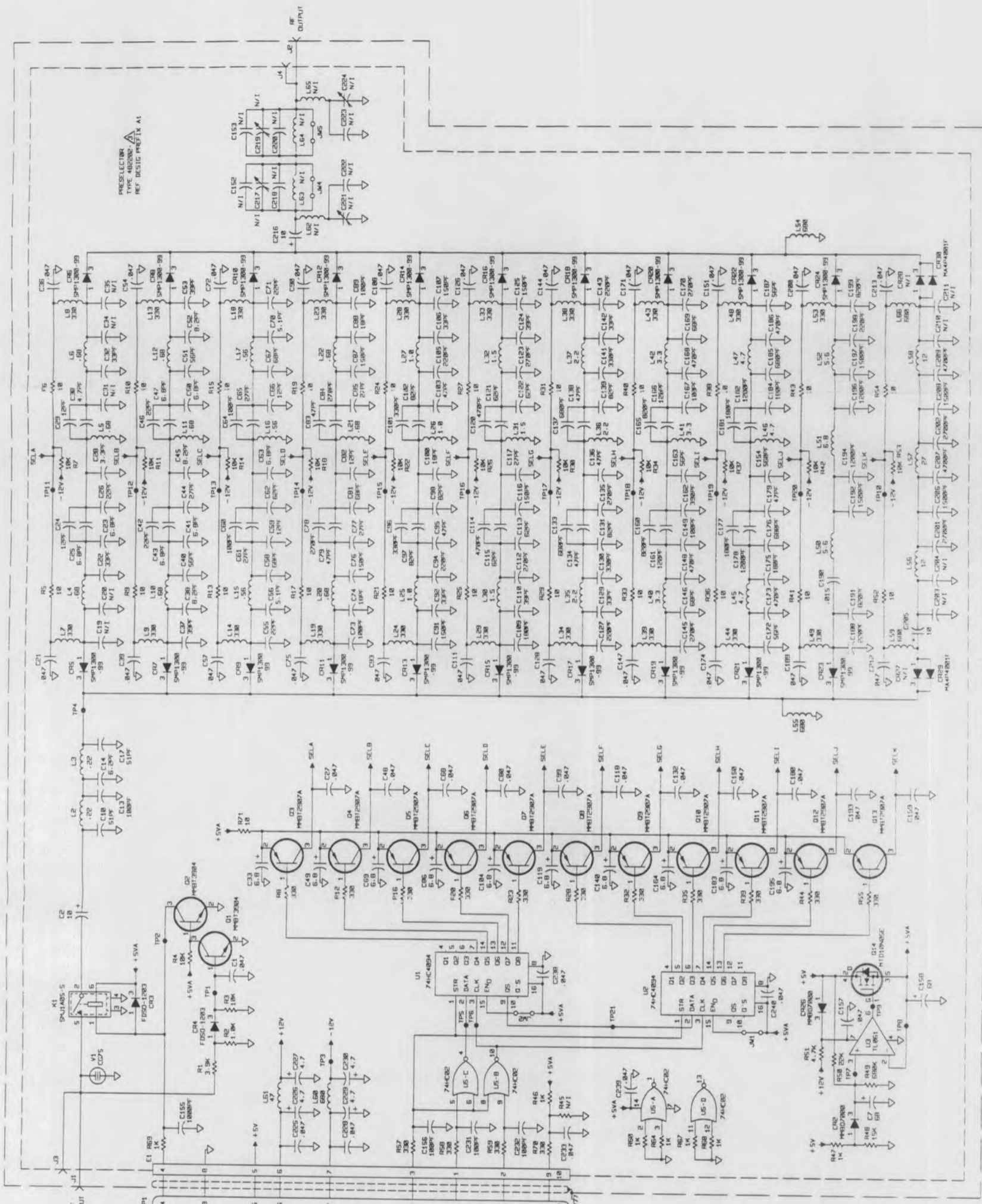
REPLACEMENT PARTS LIST

WJ-8711/PRE SUBOCTAVE PRESELECTOR OPTION

REF DESIG PREFIX A4A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R56	Not Used				
R57	Same as R8				
R58	Same as R8				
R59	Same as R8				
R60	Same as R2				
R61	Not Used				
R62	Not Used				
R63	Not Used				
R64	Same as R2				
R65	Not Used				
R66	Not Used				
R67	Same as R2				
R68	Same as R2				
R69	Same as R2				
R70	Same as R8				
R71	Same as R5				
U1	Integrated Circuit, CMOS, 8B BUS-COMPATIBLE SHF ST LCH	2	74HC4094 SO16	34371	
U2	Same as U1				
U3	Amplifier LOW PWR JFET INPUT OPERATIONAL Amplifier SO-8	1	TL061CD	04713	
U4	Not Used				
U5	Integrated Circuit, QUAD 2-INPUT NOR GATE	1	74HC02 SO14	02735	
V1	ARRESTER GAS DISCHARGE SURGE	1	CG75L	71482	





NOTES:

1. UNLESS OTHERWISE SPECIFIED:  
 A) RESISTANCE IS IN OHMS,  $\pm 5\%$ , 1/10W  
 B) CAPACITANCE IS IN  $\mu F$ .  
 C) INDUCTANCE IS IN  $\mu H$ .
2. A 14 PIN DIP SOCKET IS PROVIDED FOR INSTALLATION OF K2.
3. DIFFERENCE BETWEEN -1 AND -2 IS MECHANICAL ONLY. -3 IS CONFORMAL COATED VERSION OF -2.

Figure B-5. Type 797033-1 Preselector Assembly (A4), Schematic Diagram 581356 (D)

**APPENDIX C**

**RESERVED FOR A FUTURE OPTION**

**APPENDIX D**

**TYPE WJ-8710/DSO1, WJ-8711/DSO1, AND WJ-8712/DSO1**

**DIGITAL SIGNAL OUTPUT OPTIONS**

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March 1995

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**WJ-8710/DSO1, WJ-8711/DSO1, AND WJ-8712/DSO1 OPTIONS**

**REVISION RECORD**

Revision	Description	Date
A	Initial Issue.	9/93
B	Expand to detail various receiver models.	5/94
C	Add information about IF data spectrum inverstion.	6/94
D	Added table detailing DSO1 output functions versus mode.	12/94

**APPENDIX D**

**TYPE WJ-8710/DSO1, WJ-8711/DSO1, WJ-8712/DSO1**

**DIGITAL SIGNAL OUTPUT OPTIONS**

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**APPENDIX D**

**TYPE WJ-8710/DSO1, WJ-8711/DSO1, AND WJ-8712/DSO1**

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**APPENDIX D****TYPE WJ-8710/DSO1, WJ-8711/DSO1, AND WJ-8712/DSO1****DIGITAL SIGNAL OUTPUT OPTIONS****D.1 INTRODUCTION**

This document provides installation and configuration setup procedures for the Digital Signal Output options: WJ-8710/DSO1, WJ-8711/DSO1, and WJ-8712/DSO1. The WJ-8710/DSO1 is used on the WJ-8710 and WJ-8710A Digital HF Receivers. The WJ-8711/DSO1 is used on the WJ-8711 and WJ-8711A receivers. The WJ-8712/DSO1 is used on the WJ-8712, WJ-8712A and WJ-8712P receivers.

**D.2 ELECTRICAL CHARACTERISTICS**

The DSO1 Digital Signal Output (DSO) option provides digital data output from the Digital HF Receiver.

This digital data is intended for external digital signal processing, and is available via a 15-pin D-type subminiature connector. This connector is mounted on the front panel of the WJ-8710 and WJ-8710A receivers (refer to **Figure D-1(A)**). The connector is mounted on the rear panel of the WJ-8711 and WJ-8711A (refer to **Figure D-1 (B)**), and the WJ-8712, WJ-8712A and WJ-8712P (refer to **Figure D-1 (C)**).

The DSO1 option provides data samples of 16-bit resolution at 100 kHz, in twos complement format with the Most Significant Bit (MSB) first. A range of data sources can be represented by the digital output including representations of the prefiltered, not fine-tuned, third IF centered at 25 kHz (via the ADC); the post-filtered fine-tuned switched IF centered at 25 kHz; and the demodulated audio signal. However, this range varies depending on the selection of one of three modes. These modes, whose related outputs are depicted in **Figure D-2** and **Table D-1**, are:

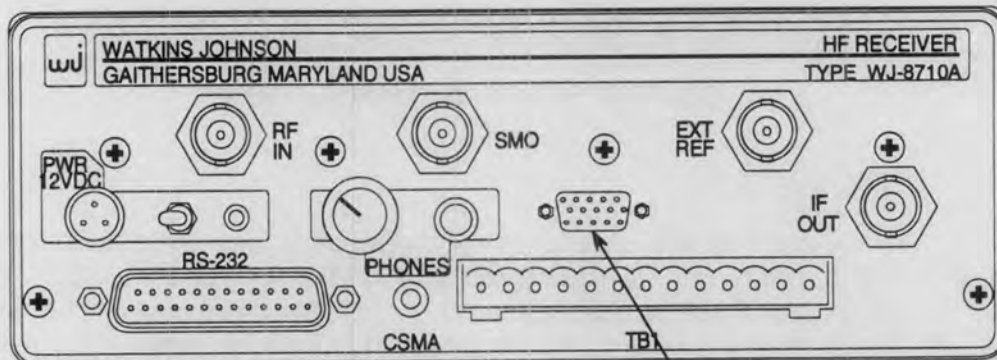
- Eight-bit TTL parallel mode,
- Serial TTL mode, or
- Serial Differential mode with constant current drivers.

In eight-bit TTL parallel mode, the data can be sourced from one of the following:

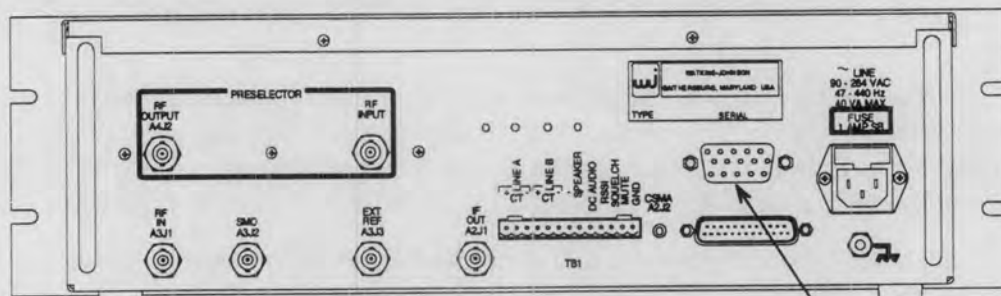
- Pre-filtered Third IF data (centered at 25 kHz) converted by an analog-to-digital converter (ADC) that has not been fine-tuned,
- Multiplexed Post-filtered fine-tuned IF data (centered at 25 kHz) /demodulated Audio,
- Post-filtered fine-tuned IF data (centered at 25 kHz), or
- Demodulated audio

In serial TTL mode, the data is simultaneously sourced from all of the following:

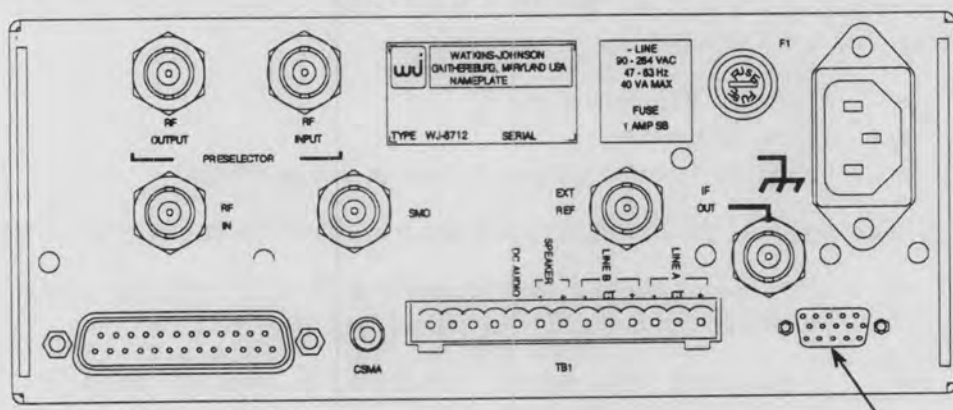
- Pre-filtered not fine-tuned Third IF data (via ADC),
- Multiplexed post-filtered fine-tuned IF/demodulated audio,
- Post-filtered fine-tuned IF centered at 25 kHz, or
- Demodulated audio



(A) WJ-8710 AND WJ-8710A

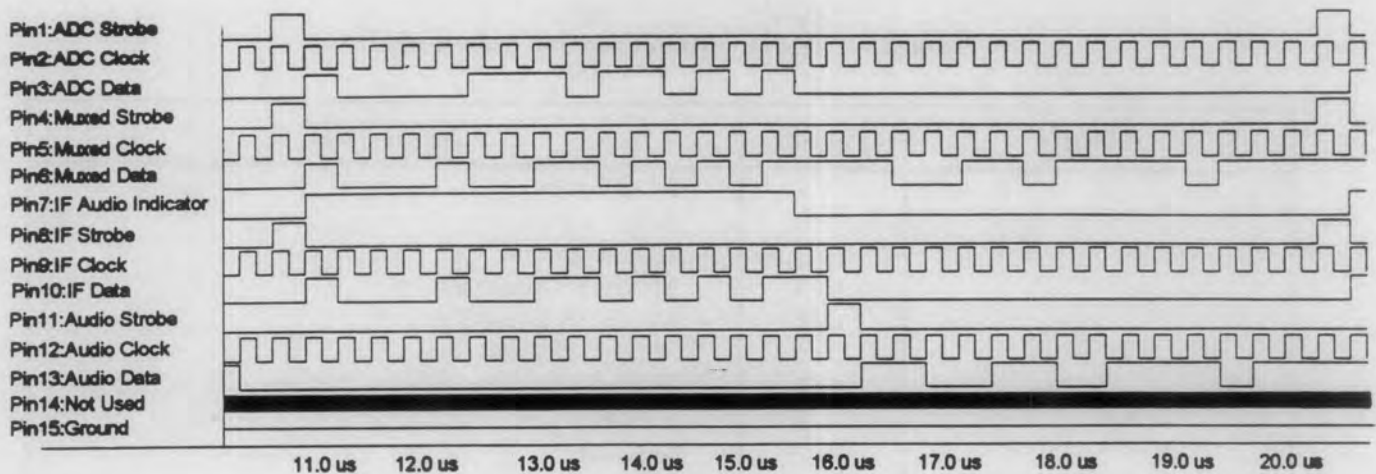


(B) WJ-8711 AND WJ-8711A

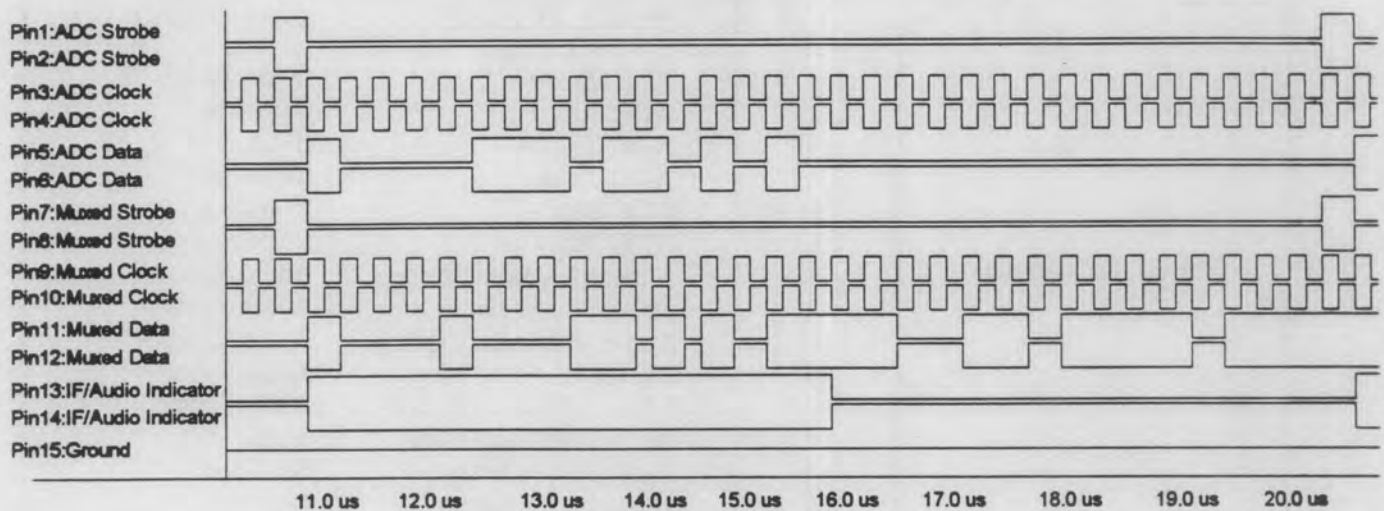


(C) WJ-8712, WJ-8712A AND WJ-8712P

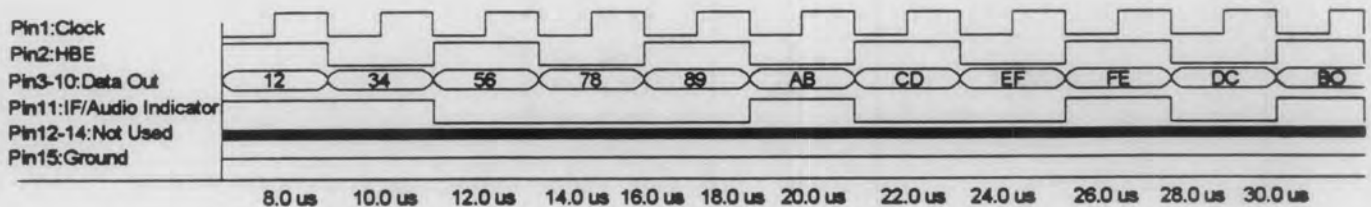
Figure D-1. Location of DSO1 Output Connector W4P2



(A) Serial TTL Level Output



(B) Serial Differential Output



(C) 8 Bit TTL Output

Figure D-2. DSO1 Signal Outputs Versus Selected Mode

**Table D-1. DSO1 Output Function Versus Mode**

Mode	Pin No.	Signal Name	
Serial, TTL Level	1	ADC Strobe	
	2	ADC Clock	
	3	ADC Data	
	4	Muxed IF/Audio Strobe	
	5	Muxed IF/Audio Clock	
	6	Muxed IF/Audio Data	
	7	IF/Audio* Indicator	
	8	IF Strobe	
	9	IF Clock	
	10	IF Data	
	11	Audio Strobe	
	12	Audio Clock	
	13	Audio Data	
	14	Not Used	
	15	GND	
Serial, Differential		<u>When S1SW3 is OFF</u>	<u>When S1SW3 is ON</u>
	1	ADC Strobe +	IF Strobe +
	2	ADC Strobe -	IF Strobe -
	3	ADC Clock +	IF Clock +
	4	ADC Clock -	IF Clock -
	5	ADC Data +	IF Data +
	6	ADC Data -	IF Data -
	7	Muxed IF/Audio Strobe +	Audio Strobe +
	8	Muxed IF/Audio Strobe -	Audio Strobe -
	9	Muxed IF/Audio Clock +	Audio Clock +
	10	Muxed IF/Audio Clock -	Audio Clock -
	11	Muxed IF/Audio Data +	Audio Data +
	12	Muxed IF/Audio Data -	Audio Data -
	13	IF/Audio* Indicator +	Not Used
	14	IF/Audio Indicator -	Not Used
15	GND	GND	
8-Bit Parallel	1	Clock	
	2	High Byte Enable	
	3	Data out (0)	
	4	Data out (1)	
	5	Data out (2)	
	6	Data out (3)	
	7	Data out (4)	
	8	Data out (5)	
	9	Data out (6)	
	10	Data out (7)	
	11	IF/Audio* Indicator (only in muxed mode)	
	12	Not Used	
	13	Not Used	
	14	Not Used	
	15	GND	

In serial differential mode, the data can be sourced from one of the following:

- Pre-filtered Third IF centered at 25 kHz (via ADC) that is not fine-tuned and Multiplexed Post-Filtered IF centered at 25 kHz/Demodulated Audio, or
- Pre-filtered Third IF (via ADC) centered at 25 kHz that is not fine-tuned and demodulated Audio.

In each mode, the IF data taken direct from the A/D converter (not multiplexed), has an inverted spectrum relative to the input. The IF data in the multiplexed output signal has been re-inverted by DSP operations to a normal spectrum.

The bandpass of the post-filtered IF data is dependent on the current bandpass filter selection. The board's architecture is very flexible, and can be easily modified to support a variety of protocols through the use of a programmable gate array. Please contact your Watkins-Johnson representative for details.

### D.3 MECHANICAL CHARACTERISTICS

The Digital Signal Output option consists of the Type 797093-1 Digital Signal Output PC Assembly (A2A1) and a Type 383295-1 Cable Assembly (W4) for routing signals to the rear or front panel of the receiver. Mounting hardware and mating connector hardware is provided to satisfy assembly and cabling requirements.

### D.4 OVERALL FUNCTIONAL DESCRIPTION

Multiplexed post-filtered fine-tuned IF (IF), demodulated audio, or pre-filtered not fine-tuned Third IF signals (referred to as ADC because these analog signals have undergone ADC conversion) are applied to the Digital Signal Output option daughterboard for processing. Programmable logic reclocks the incoming signals; converts the input signals to parallel, if required; demultiplexes the IF/Audio multiplex line; and provides a separate IF or Audio line, if required. The output signals are then routed to the DSO output connector.

### D.5 INSTALLATION

The Digital Signal Output option is installed in the receiver at the factory when ordered with the receiver.

#### D.5.1 CONNECTOR SIGNALS

All DSO1 output signals are accessed at the DSO connector (W4P2) located on the rear or front panel of the receiver (refer to **Figure D-1**). **Figure D-2** lists the signal name at each pin, for each mode, and provides a view of each.

D.6 **DSO1 CONFIGURATION SETUP**

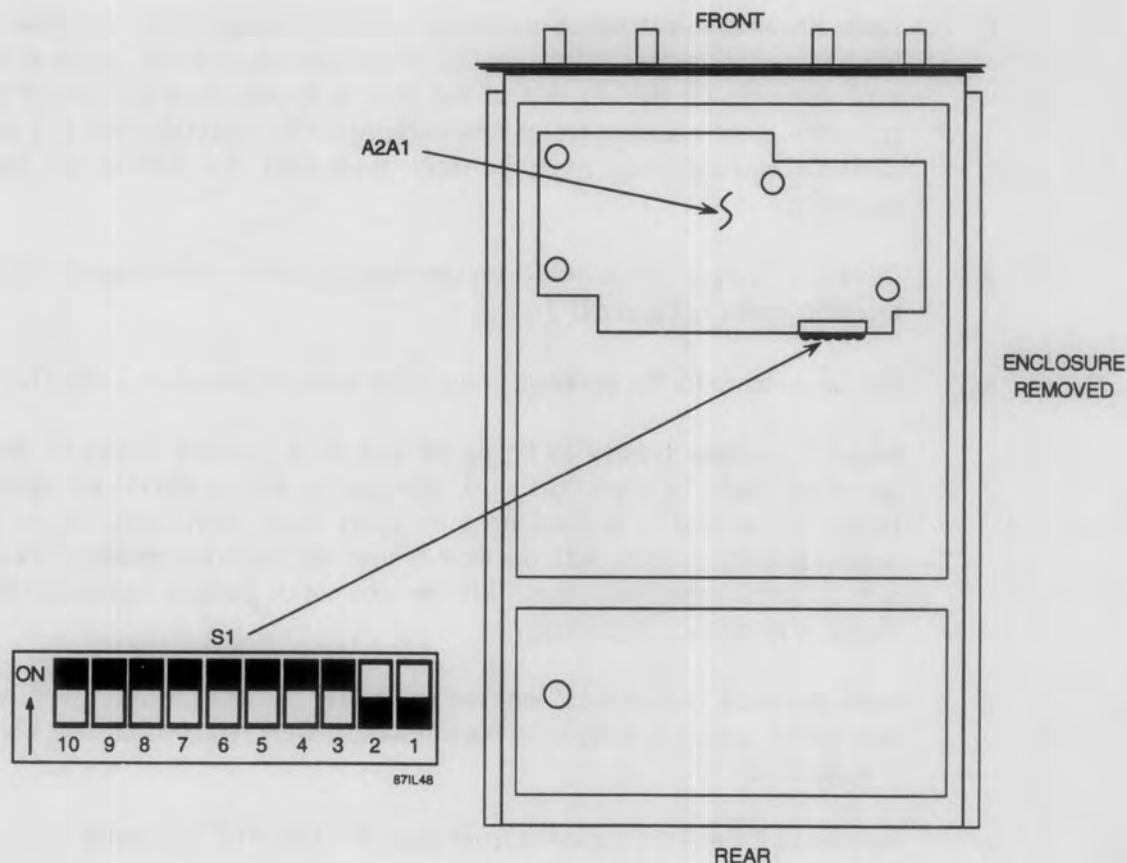
The DSO1 Digital Signal Output option processes and outputs signals in accordance with the settings of DIP switch S1 located on the Digital Signal Output PC Assembly (A2A1). See **Figure D-3, D-4** and **D-5**. The switch must be set in accordance with **Table D-2**.

**Table D-2. Switch Settings of DIP Switch A2A1S1**

Position 5 (Interface):		
OFF = TTL Level Output	ON = Differential Output (Serial mode only)	
Position 6 (Clock Polarity):		
OFF = Data changes on falling edge	ON = Data changes on rising edge	
Position 7, 8 (Data Source):		
<b>In parallel mode:</b>		
Source	<u>Pos. 8</u>	<u>Pos. 7</u>
Pre-filtered Third IF (ADC)	ON	ON
Multiplexed Post-Filtered IF & Audio	OFF	ON
Post-filtered IF	ON	OFF
Demodulated Audio	OFF	OFF
<b>In Serial Differential mode:</b>		
<u>Source</u>	<u>Pos. 8</u>	<u>Pos. 7</u>
Pre-filtered Third IF (ADC) and Multiplexed Post-Filtered IF/Audio	ON	OFF
Pre-filtered Third IF, Audio	OFF	OFF
<b>In Serial TTL mode:</b>		
<u>Source</u>	<u>Pos. 8</u>	<u>Pos. 7</u>
Pre-filtered Third IF (ADC), Multiplexed Post-Filtered IF/Audio, Post-filtered fine-tuned IF and Demodulated Audio	OFF	OFF
Position 9, 10 (Data Format):		
<u>Format</u>	<u>Pos. 10</u>	<u>Pos. 9</u>
Serial Mode	OFF	OFF
8 bit TTL Parallel	OFF	ON

Note 1: Switch Positions 4, 3, 2, 1 = OFF (All Modes)

Note 2: As positioned on PC Assembly, ON is up; OFF is down.



**Figure D-3. Location of DSO1 DIP Switch S1 in the WJ-8710 and WJ-8710A**

**D.6.1 ACCESSING DIP SWITCH S1 ON THE DIGITAL SIGNAL OUTPUT PC ASSEMBLY**

**D.6.1.1 WJ-8710 and WJ-8710A Digital HF Receiver**

Perform the following procedural steps to gain access to the DSO1 DIP switch S1:

- a. Turn off the receiver and disconnect the power plug from the front panel PWR 12 VDC connector.
- b. Remove two black pan-head screws from the lower left and right corners of the front panel.
- c. Remove four flat-head screws and two pan-head screws from the rear panel.
- d. Remove the rear panel and then slide the main chassis (complete with front panel) out of the enclosure.
- e. Locate the RFI gasket (the long copper strip) on each side of the receiver's deck assembly (between the deck assembly and the bottom housing).

- f. Insert the special installation tool (included with the accessory kit) between the RFI gasket fingers, and the bottom housing along the entire length of the deck assembly (in the left side of the deck as viewed from the rear of the receiver). Ensure that the tool is down against the flange on the deck and then slide the housing away from the front panel until it is free of the deck assembly.
- g. Place the receiver on the bench, bottom side up, and locate S1 on the A2A1 assembly (refer to **Figure D-3**).
- h. Set the switches for the desired configuration in accordance with **Table D-2**.
- i. Install the bottom housing by laying the tool along the right side of the deck (as viewed from the rear of the unit). Position the tool so that the RFI gasket fingers are covered by the tool along the entire length of the deck. Align the bottom housing grooves with the deck flanges and slide the housing forward until it contacts the front panel. Lift the tool out of position so that the RFI fingers now contact the housing.
- j. Slide the main chassis back into the enclosure, reinstall the rear panel and secure both panels in place with the screws that were removed in steps b and c, respectively.
- k. Reconnect the power plug to the front panel PWR 12 VDC connector.

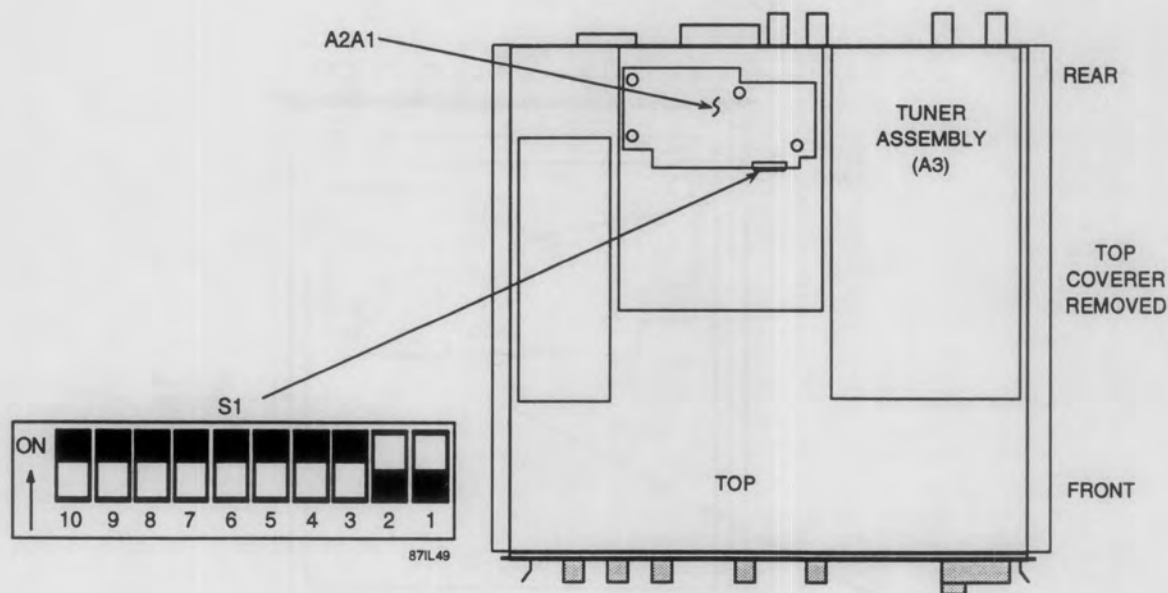
D.6.1.2

**WJ-8711 and WJ-8711A Digital HF Receiver**

Perform the following procedural steps to gain access to the DSO1 DIP switch S1:

- a. Turn off the receiver and disconnect the power plug from the rear panel power connector.
- b. Remove two pan-head screws from the rear edge of the top panel securing it to the chassis rear apron, and two flat-head screws on the forward edge of the top panel.
- c. Carefully remove top panel and disconnect the speaker leads.
- d. Locate S1 on the A2A1 assembly (refer to **Figure D-4**).
- e. Set the switches for the desired configuration in accordance with **Table D-2**.
- f. Reconnect the speaker leads to the top panel and replace the top panel on the receiver. Secure the top panel with the screws removed in step b.
- g. Reconnect power cord to the rear panel power connector.





**Figure D-4. Location of DSO1 DIP Switch S1 in the WJ-8711 and WJ-8711A**

D.6.1.3

**WJ-8712, WJ-8712A and WJ-8712P Digital HF Receiver**

Perform the following procedural steps to gain access to the DSO1 DIP switch S1:

- a. Turn off the receiver and disconnect the power plug from the rear panel power connector.
- b. Remove twelve (12) flat-head screws from the bottom cover and remove the bottom cover.
- c. Locate S1 on the A2A1 assembly (refer to **Figure D-5**).
- d. Set the switches for the desired configuration in accordance with **Table D-2**.
- e. Replace the bottom cover and secure in place with the twelve (12) screws removed in step b.
- f. Reconnect power cord to the rear panel power connector.

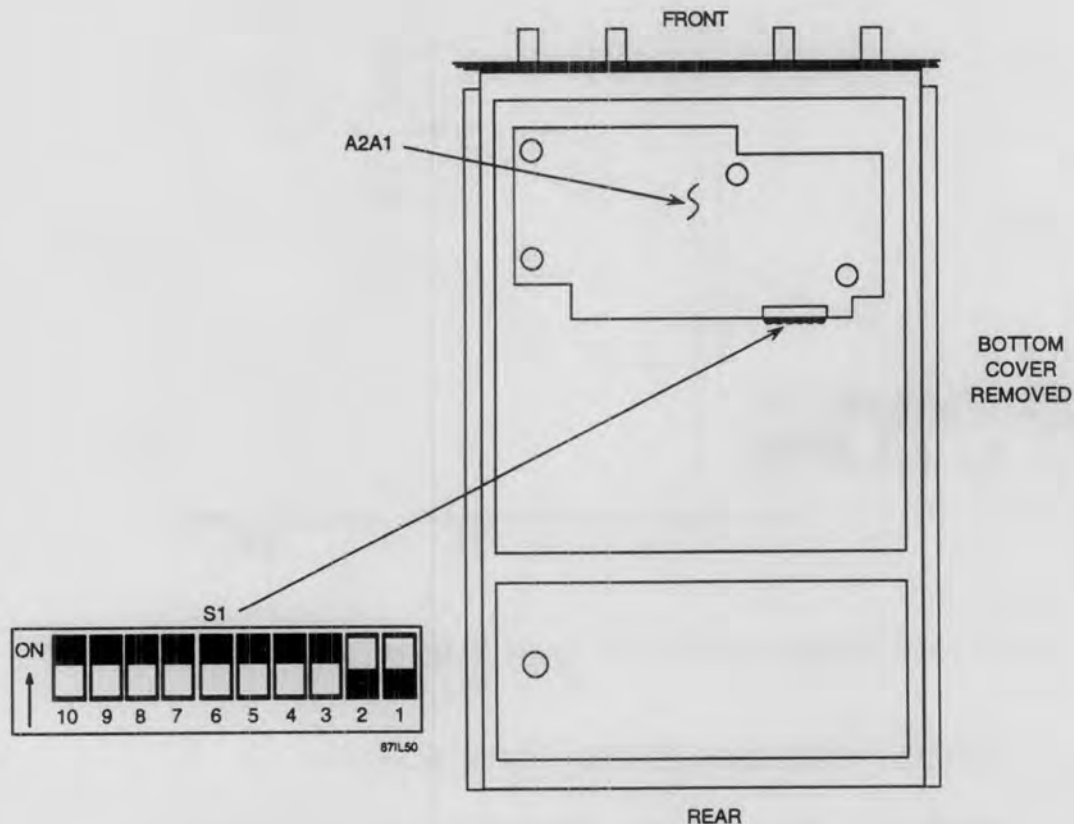


Figure D-5. Location of DSO1 DIP Switch S1 in the WJ-8712, WJ-8712A and WJ-8712P

D.7 UNIT NUMBERING METHOD

The method of numbering used throughout the unit is assigning reference designations (electrical symbol numbers) to identify: assemblies, subassemblies, modules within a subassembly, and discrete components. An example of the unit numbering method used is as follows:

Subassembly Designation A1

R1 Class and No. of Item

Identify from right to left as:

First (1) resistor (R) of  
first (1) subassembly (A)

On the main chassis schematic, components which are an integral part of the main chassis have no subassembly designations.

D.8 REFERENCE DESIGNATION PREFIX

The use of partial reference designations are used on the equipment and on the manual illustrations. This partial reference designation consists of the component type letter(s) and the identifying component number. The complete reference designation may be obtained by placing the proper prefix before the partial reference designation. Reference designation prefixes are included on the drawings and illustrations in the figure titles (in parenthesis).

D.9 **LIST OF MANUFACTURERS**

The manufacturers listed below are supply sources used for obtaining certain parts in this option, and are not listed in the base manual. All other manufacturers not listed below can be found in the base manual.

<u>Mfr. Code</u>	<u>Name and Address</u>	<u>Mfr. Code</u>	<u>Name and Address</u>
05313	McCarty Sales Inc. 112 Rittenhouse Bayfield, WI 54814	9AA35	Mepcopal Company San Diego, CA 92121
07263	Fairchild Semiconductor Div. Cupertino, CA 95014	91506	Augat Incorporated 452 John Dietsch Blvd. P.O. Box 2510 Attleboro Falls, MA 02763
67183	Altera Corporation 2610 Orchard Parkway San Jose, CA 95134-2020		

D.10 **PARTS LIST**

The following parts lists contain all the electrical components used in the unit, along with mechanical parts which may be subject to unusual wear or damage. When ordering replacement parts from the Watkins-Johnson Company, specify the unit type, the serial number, and the option configuration. Also include the reference designation and the description of each item ordered. The list of manufacturers, provided in **paragraph D.9**, and the manufacturer's part number, provided in **paragraph D.10.1**, are supplied as a guide to aid the user of the equipment while in the field. The parts listed may not necessarily be identical with the parts installed in the unit. The parts listed in **paragraph D.10.1** will provide for satisfactory unit operation.

Replacement parts may be obtained from any manufacturer provided that the physical characteristics and electrical parameters of the replacement item are compatible with the original part. In the case where components are defined by a military or industrial specification, a vendor which can provide the necessary component is suggested as a convenience to the user.

**NOTE**

As improved semiconductors become available, it is the policy of Watkins-Johnson to incorporate them in proprietary products. For this reason some transistors, diodes and integrated circuits installed in the equipment may not agree with those specified in the parts lists and schematic diagrams of this manual. However, the semiconductors designated in the manual may be substituted in every case with satisfactory results.

REPLACEMENT PARTS LIST

WJ-8710/DSO1, WJ-8711/DSO1, AND WJ-8712/DSO1 OPTIONS

D.10.1 TYPE WJ-8710/DSO1, WJ-8711/DSO1, AND WJ-8712/DSO1  
DIGITAL SIGNAL OUTPUT OPTION 1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
A2A1	Revision X1 Digital Signal Output PC Assembly	1	797093-1	14632	
W4	Cable Assembly	1	383295-1	14632	
	<u>Accessory Items</u>				
AI-1	Connector, D-Sub 15 Pin	1	K86-EA-15P	05313	
AI-2	Shell, 15 pin Connector	1	207908-1	00779	

WJ-8710/DSO1, WJ-8711/DSO1, AND WJ-8712/DSO1 OPTIONS

REPLACEMENT PARTS LIST

D.10.1.1 Type 797093-1 Digital Signal Output PC Assembly

REF DESIG PREFIX A2A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
	Revision 01				
C1	Capacitor, Ceramic: .047 $\mu$ F, 10%, 50 VDC	8	841415-023	14632	
C2 Thru C8	Same as C1				
C9	Capacitor, Ceramic: .01 $\mu$ F, 10%, 50 V	18	841415-019	14632	
C10	Same as C9				
C11	Capacitor, Ceramic: 100 pF, 5%, 50 V NPO	66	841415-007	14632	
C12	Same as C11				
C13 Thru C15	Same as C9				
C16	Capacitor, Tantalum: 33 $\mu$ F, 20%, 16 V	1	841293-22	14632	
C17	Capacitor, Tantalum: 15 $\mu$ F, 20%, 25 V	2	841293-19	14632	
C18	Same as C17				
C19 Thru C54 C55 Thru C63 C64 Thru C91	Same as C11				
C92	Capacitor, Ceramic: 82 pF, $\pm$ 2%, 50 V NPO	1	841416-047	14632	
C93	Capacitor, Ceramic: 39 pF, 2%, 50 V NPO	1	841416-039	14632	
C94	Capacitor, Ceramic: 560 pF, 2%, 50 V NPO	1	841416-067	14632	
C95	Same as C9				
C96	Same as C9				
C97	Capacitor, Ceramic: 470 pF, 2%, 50 V NPO	1	841416-065	14632	
C98	Capacitor, Ceramic: 2200 pF, 10%, 50 V	1	841415-015	14632	
C99	Capacitor, Ceramic: 270 pF, 2%, 50 V NPO	2	841416-059	14632	
C100	Capacitor, Ceramic: 150 pF, 2%, 50 V NPO	1	841416-053	14632	
C101	Capacitor, Ceramic: 330 pF, 2%, 50 V NPO	1	841416-061	14632	
C102	Capacitor, Ceramic: 1500 pF, 2%, 50 V NPO	1	841416-077	14632	
C103	Capacitor, Ceramic: 390 pF, 2%, 50 V NPO	1	841416-063	14632	
C104	Capacitor, Ceramic: 180 pF, 2%, 50 V NPO	1	841416-055	14632	
C105	Same as C99				
C106	Same as C9				
C107	Same as C9				
C108	Capacitor, Ceramic: 1200 pF, 2%, 50 V NPO	1	841416-075	14632	
C109	Capacitor, Ceramic: 1000 pF, 2%, TOL, 50 V NPO	1	841416-073	14632	
C110	Capacitor, Ceramic: .33 $\mu$ F	1	841293-01	14632	
C111	Capacitor, Ceramic: 1.0 $\mu$ F	1	841293-04	14632	
C112	Capacitor, Ceramic: .1 $\mu$ F	2	841250-25	14632	

## REPLACEMENT PARTS LIST

WJ-8710/DSO1, WJ-8711/DSO1, AND WJ-8712/DSO1 OPTIONS

## REF DESIG PREFIX A2A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C113	Same as C112				
CR1	Diode	10	MBAV74	04713	
CR2					
Thru	Same as CR1				
CR10					
E1	Not Installed				
J1	Connector, PC Board: 24-Pin Dbl Row Skt	2	SSW-112-01-T-G-D	55322	
J2	Same as J1				
J3	Not In Circuit				
J4	Connector, Receptacle: 20-POS DBL ROW MALE	1	M80-8662622		
J5	Not Installed				
J6	Not Installed				
J7	Connector, PC Board: 3 POS SGL ROW SKT	1	SSW-103-01-T-S	55322	
R1	Resistor, Fixed: 10 k $\Omega$ , 5%, 1/10 W	15	841414-097	14632	
R2					
Thru	Same as R1				
R10					
R11					
Thru	Not Installed				
R48					
R49	Jumper: .05 $\Omega$	24	841417	14632	
R50					
Thru	Same as R49				
R72					
R73	Resistor, Fixed: 56 $\Omega$ , 5%, 1/10 W	24	841414-043	14632	
R74					
Thru	Same as R73				
R96					
R97	Resistor, Fixed: 9.1 k $\Omega$ , 5%, 1/10 W	3	841414-096	14632	
R98	Same as R97				
R99	Same as R97				
R100	Resistor, Fixed: 3.3 k $\Omega$ , 5%, 1/10 W	1	841414-085	14632	
R101	Resistor, Fixed: 6.8 k $\Omega$ , 5%, 1/10 W	2	841414-093	14632	
R102	Resistor, Fixed: 4.7 k $\Omega$ , 5%, 1/10 W	3	841414-089	14632	
R103	Resistor, Fixed: 220 k $\Omega$ , 5%, 1/10 W	1	841414-129	14632	
R104	Resistor, Fixed: 1.0 k $\Omega$ , 5%, 1/10 W	4	841414-073	14632	
R105	Same as R104				
R106	Same as R1				
R107	Resistor, Fixed: 330 $\Omega$ , 5%, 1/10 W	1	841414-061	14632	
R108	Resistor, Fixed: 3.9 k $\Omega$ , 5%, 1/10 W	1	841414-087	14632	
R109	Resistor, Fixed: 8.2 k $\Omega$ , 5%, 1/10 W	2	841414-095	14632	
R110	Same as R1				
R111	Resistor, Fixed: 47 k $\Omega$ , 5%, 1/10 W	1	841414-113	14632	
R112	Same as R1				

WJ-8710/DSO1, WJ-8711/DSO1, AND WJ-8712/DSO1 OPTIONS

REPLACEMENT PARTS LIST

REF DESIG PREFIX A2A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R113	Same as R109				
R114	Same as R102				
R115	Same as R1				
R116	Same as R101				
R117	Resistor, Fixed: 33 kΩ, 5%, 1/10 W	1	841414-109	14632	
R118	Same as R104				
R119	Same as R104				
R120	Same as R1				
R121	Same as R102				
R122	Resistor, Fixed: 100Ω, 5%, 1/10 W	1	841414-049	14632	
R123	Resistor, Fixed: 91Ω, 5%, 1/10 W	2	841414-048	14632	
R124	Resistor, Fixed: 82Ω, 5%, 1/10 W	1	841414-047	14632	
R125	Same as R123				
S1	Switch, Dip: 10 POS SPST Side-Actuated	1	GDP10S	95146	
S2	Switch: 8 POS Slide	1	CHS08A	9AA35	
S3	Switch, Dip: SPSt Side-Actuated	1	GDP-08S	95146	
U1	Integrated Circuit, EPLD	1	EPM7096LC84-3	67183	
U2	Integrated Circuit: Line Driver and Receiver Monolithic	1	SN75155D	01295	
U3	Integrated Circuit (OBS): Quadruple Line Drivers	3	SN75111D	01295	
U4	Same as U3				
U5	Same as U3				
U6	Integrated Circuit, CMOS: Octal Buffer/Line Driver	3	8674AC244S020U	07263	
U7	Same as U6				
U8	Same as U6				
U9	Amplifier	2	MC33182D	04713	
U10	Same as U9				
U11	Voltage Regulator: -5 V	1	MC79M05CDT	14632	
XU1	Socket, PLCC: 84-Pin LO Profile	1	PCS-084-SMU-11T	91506	

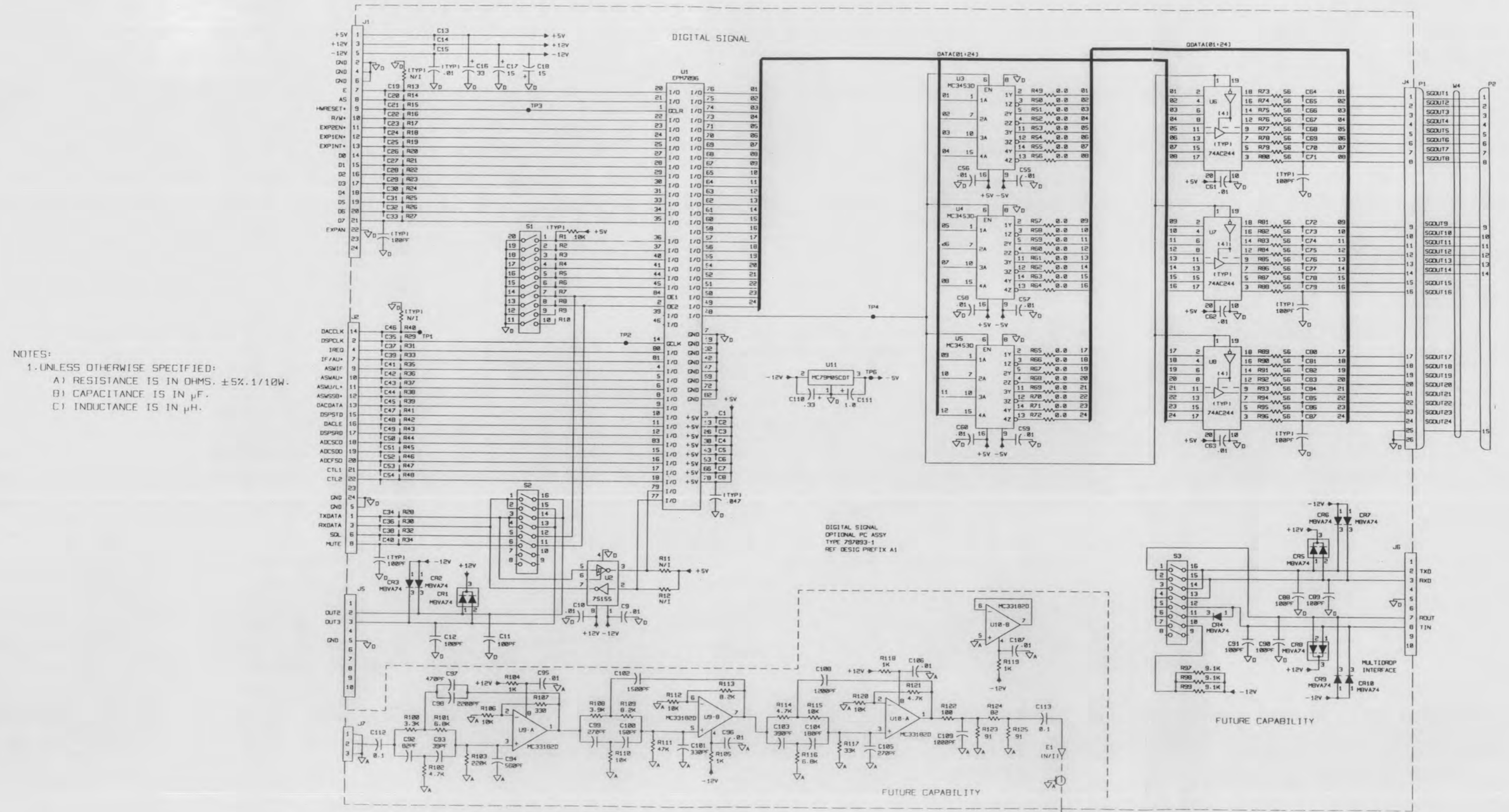


Figure D-6. Type 797093-1 Digital Signal Output PC Assembly (A2A1), Schematic Diagram 581452 (B)



**APPENDIX G**

**WJ-871Y/PCSM2 PERSONAL COMPUTER**

**SIGNAL MONITOR OPTION**

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May 1995

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**WJ-871Y/PCSM2 PERSONAL COMPUTER**

**SIGNAL MONITOR OPTION**

**REVISION RECORD**

Revision	Description	Date
A	Initial Release.	5/95

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**APPENDIX G**

**WJ-871Y/PCSM2 PERSONAL COMPUTER**

**SIGNAL MONITOR OPTION**

APPENDIX G

WJ-871Y/PCSM2 PERSONAL COMPUTER SIGNAL MONITOR OPTION

G.1 ELECTRICAL CHARACTERISTICS

The WJ-871Y/PCSM2 Personal Computer Signal Monitor option enables the user to perform receiver control and monitoring functions via an IBM PC-compatible computer. Receiver parameters are displayed and modified using the WJ-871Y/PCSM2 Control and Monitoring Application software provided with the WJ-871Y/PCSM2 option. This software is a Microsoft© Windows-compatible program which drives the interface and provides an easy-to-use desk-type control program, allowing the operator to perform receiver control functions with simplicity, flexibility, and speed. In addition, a real time IF panoramic display is available for use as a receiver tuning aid.

G.2 MECHANICAL CHARACTERISTICS

The WJ-871Y/PCSM2 Personal Computer Signal Monitor option consists of a Digital Expansion PC Assembly (WJ P/N 797201-3), a cable assembly (WJ P/N 283254-1) for routing signals to the rear panel of the receiver, five standoffs for mounting the assembly, and an accessory kit. The option may be installed at the factory at the time of order or field installed in units equipped with software versions 4.01.02 or greater. Units must have a Type 797012 Digital Control Assembly (A2) with a dash 3 or greater type number suffix, or a Type 797214-1 Digital Control Assembly (A2) installed. This option functions with any option configuration except for configurations containing the WJ-871Y/SEU or WJ-871Y/DSO options.

The Digital Expansion PC Assembly is a daughterboard which is piggyback-mounted (via standoffs) to the receiver's Digital Control PC Assembly. One end of the cable assembly (W1) is connected to the 9-pin D-type connector on the rear panel of the unit (refer to **Figure G-1**) while the other end is connected to the daughterboard. Mounting hardware and mating connector hardware is provided to satisfy assembly and cabling requirements.

RS-232 cable assemblies, a null modem adapter, and an Arnet type POR-0002-XX-232I I/O Communications board are accessory kit items that are provided for connecting the receiver to the computer. The I/O Communications board is to be installed in any available expansion slot of the Computer where the control program will reside.

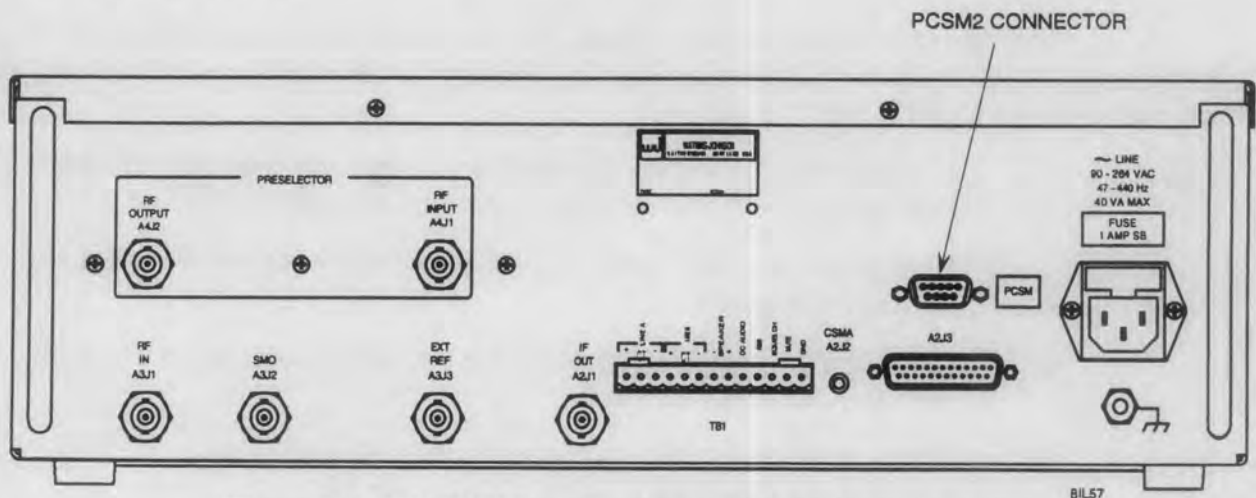


Figure G-1. WJ-871Y Rear Panel with PCSM2 Option Installed



### G.3 INSTALLATION

The WJ-871Y/PCSM2 Personal Computer Signal Monitor option is installed in the WJ-871Y Digital HF Receiver at the factory when ordered with the receiver. This option may be installed in the field for units equipped with software versions 4.01.02 or greater (refer to **paragraph G.2** for further details). In both cases, the user must install the supplied I/O Communications Board and the WJ-871Y/PCSM2 Control and Monitoring Application software in the computer which will be controlling the receiver.

The Application software (provided by both 5¼" and 3½" floppy discs) can be run from any IBM PC-compatible computer equipped with the supplied I/O Communications board and the following:

- 386/20 microprocessor,
- VGA display,
- 40 MB hard disk drive,
- 5¼" or 3½" floppy disc drive,
- mouse,
- 4 MB total RAM (recommended),
- DOS Version 5.0 or higher, and
- Microsoft Windows Version 3.1 or higher.

A mouse must be used with the WJ-871Y/PCSM2 Control and Monitoring Application software. To use a mouse, the PC must be equipped with two COM ports or one COM port and a mouse port. The mouse is connected to the mouse port or to an available COM port.

Perform the procedures described in **paragraph G.3.1** to install the I/O Communications Board and **paragraph G.3.2** to install the software. Refer to **paragraph G.3.3** for field installation procedures for the Type 797201-3 Digital Expansion Assembly, if required.

#### G.3.1 INSTALLING THE I/O COMMUNICATIONS BOARD

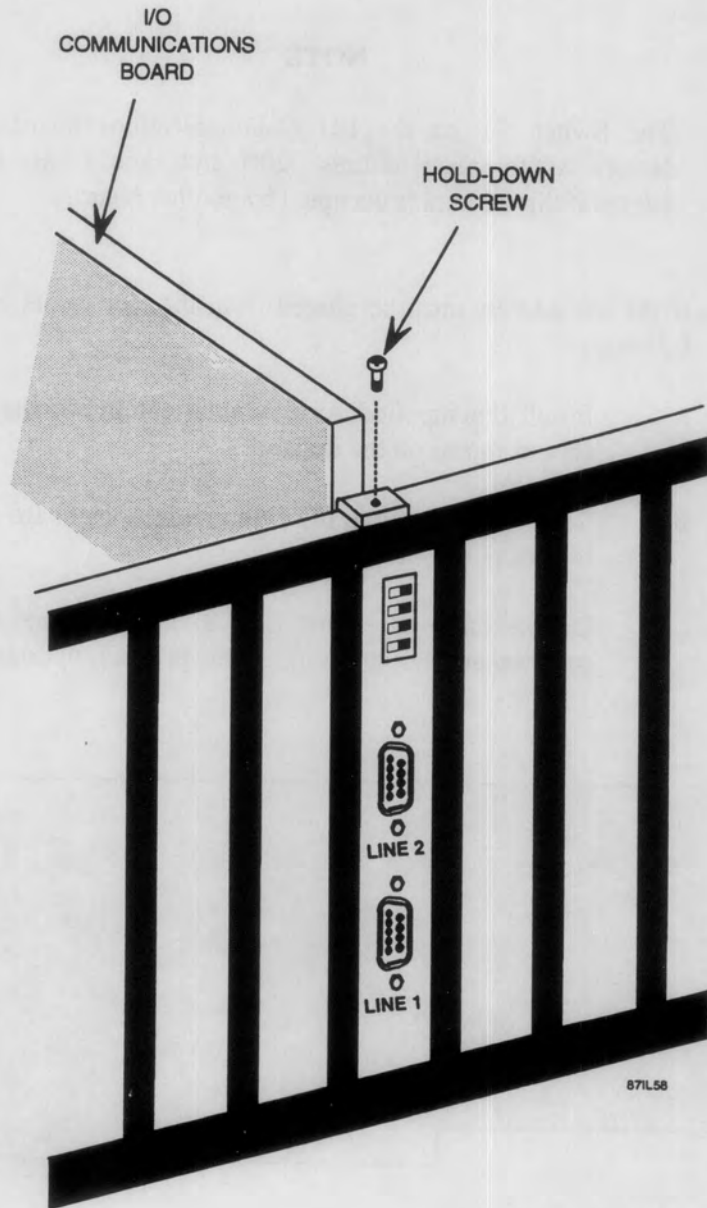
##### **WARNING**

Before proceeding with installation of the I/O Communications board, remove power from the computer.

The WJ-871Y/PCSM2 option requires that the supplied I/O Communications board be installed into one of the computer's 16-bit expansion slots. Perform the following procedures to install the I/O Communications board and cabling:

- |                  |  |
|------------------|--|
| <u>I/O Board</u> | <ol style="list-style-type: none"><li>1. Remove the top cover from the computer to expose the computer's expansion slots (refer to the computer's instruction manual for more information).</li><li>2. Remove the blank card bracket and hold-down screw from the expansion slot selected for installation.</li><li>3. Insert the I/O Communications board into the expansion slot socket and gently push the board firmly into place.</li></ol> |
|------------------|--|

4. Replace the hold-down screw to secure the board (**Figure G-2**).



**Figure G-2. Securing the I/O Communications Board**

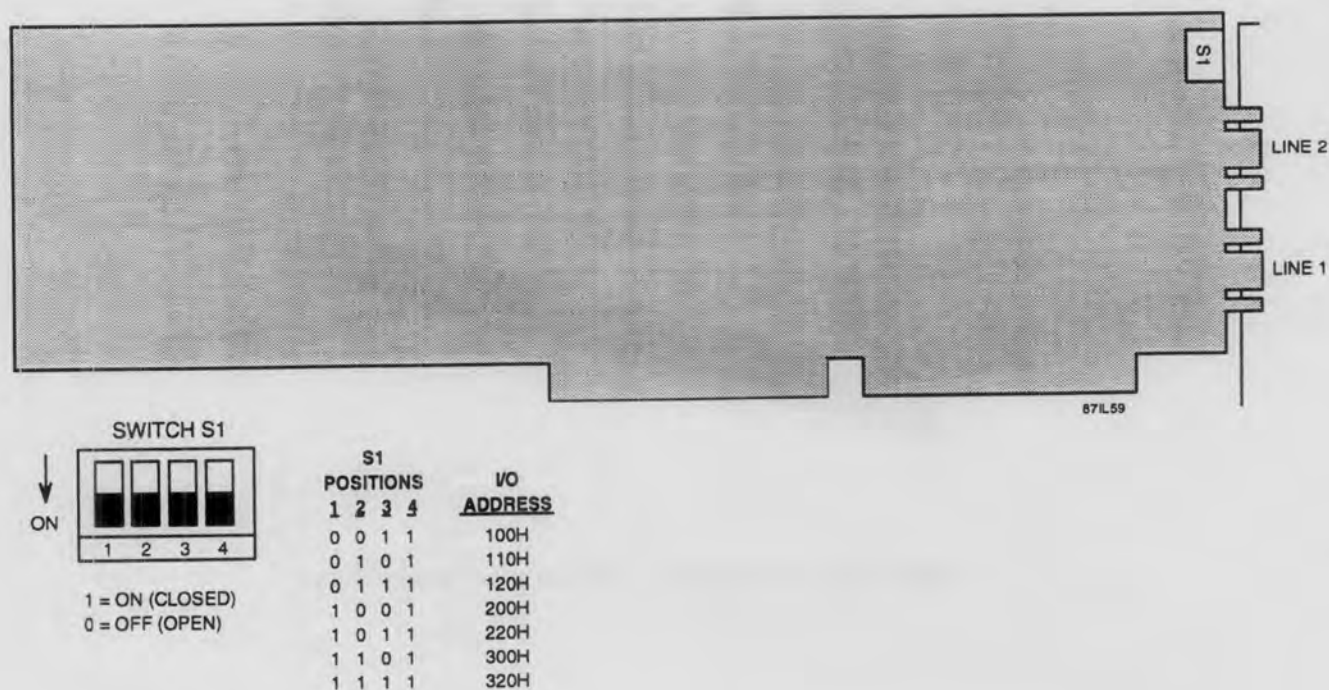
5. Replace the computer's top cover.
6. Determine the desired starting I/O address of the I/O Communications board.

**NOTE**

The Switch S1 on the I/O Communications board is factory set to select address 320H and should only be altered if this address is occupied by another board.

If the I/O address must be altered from the factory set address, perform the following:

- a. Install the supplied Arnet Configuration software. The Arnet icon should appear on the desktop.
- b. Set switch S1 on the I/O Communications board (see **Figure G-3**) to the desired I/O address.
- c. Double click the Arnet icon to initialize the Arnet Configuration program and select the applicable program options.



**Figure G-3. Setting I/O Address Switch S1 on the I/O Communications Board**

Cabling

7. Connect LINE 1 of the I/O Communications board (DB-9 port) to connector A2J3 on the rear of the receiver (DB-25 port) using the 9-pin to 25-pin null modem adapter cable and a 25-pin to 9-pin through connector (see Figure G-4).
8. Connect LINE 2 of the I/O Communications board (DB-9 port) to the PCSM2 connector on the rear panel of the receiver (DB-9 port) using the 9-pin to 25-pin null modem adapter cable and a 25-pin to 9-pin through connector (see Figure G-4).

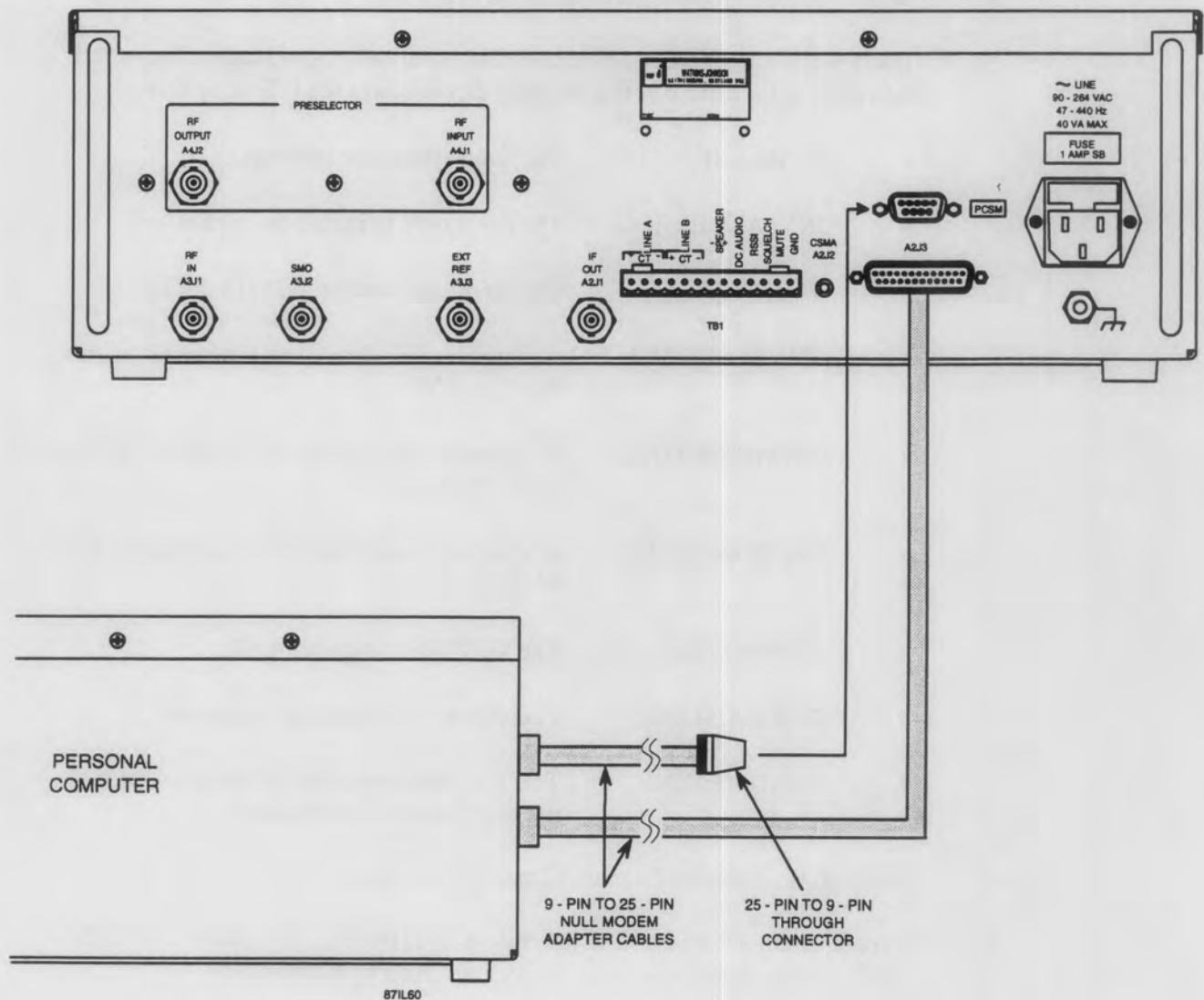


Figure G-4. Connecting the Computer to the Receiver

### G.3.2 INSTALLING THE WJ-871Y/PCSM2 CONTROL AND MONITORING APPLICATION

The WJ-871Y/PCSM2 Control and Monitoring Application software must be installed on the PC-compatible computer under Microsoft© Windows V3.1 or higher. Perform the following steps to install the programs:

1. Install Microsoft© Windows V3.1 following the instructions provided with its documentation package.
2. Start Windows by typing WIN at the DOS prompt.
3. Insert the WJ-871Y/PCSM2 Control and Monitoring Application floppy disk into drive a: (or drive b:). The program disk contains the following files:
  - PCSM.EXE            The main executable program
  - INSTALL.EXE        The executable to install the application
  - WJ871Y.DRV         The driver file used by WJ871Y.EXE.
  - XWMBA400.DLL      A dynamic link library file required to run WJ871Y.EXE.
  - XWMHN400.DLL      A dynamic link library file required to run WJ871Y.EXE.
  - XWMTE400.DLL      A dynamic link library file required to run WJ871Y.EXE.
  - CONFIG.DEV         The WJ871Y configuration file.
  - DISCLAIM.DOC      Text file with a disclaimer statement
  - README.DOC        Text file with important information that may not be included in the manual
4. Select **R**un... from the Program Manager **F**ile menu.
5. Type a:install (or b:install, if the disk is in drive b:). The WJ-871Y/PCSM Install screen should appear on the desktop (refer to **Figure G-5**).

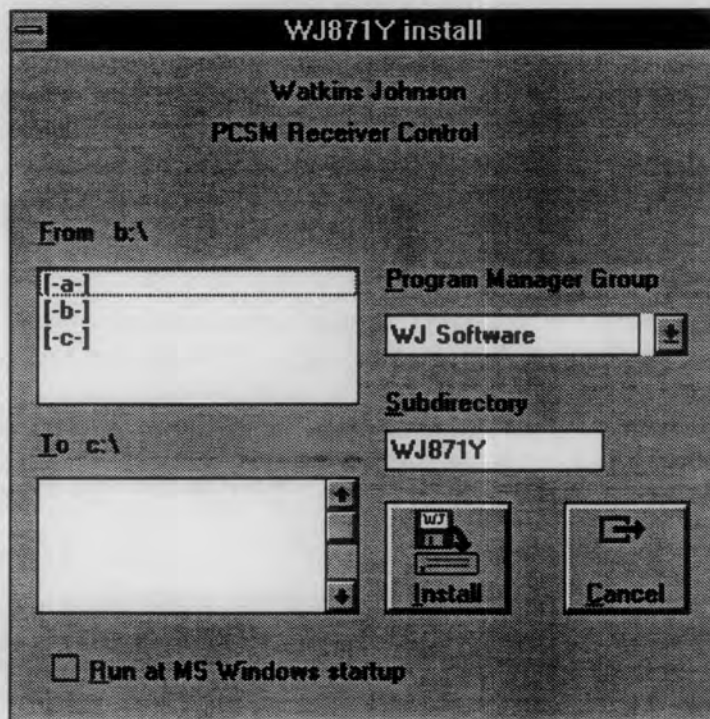


Figure G-5. WJ-871Y/PCSM Install Screen

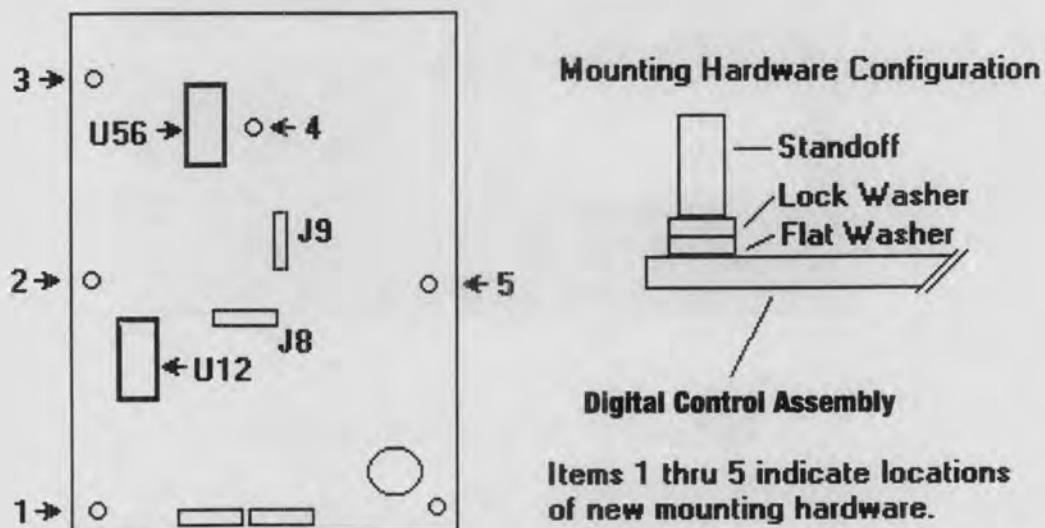
6. To accept the default installation configuration (recommended), select the Install button. Edit fields are provided allowing the user to custom select the source and destination drive specifications, Program Manager group, and target subdirectory. In addition, the user is given the option of configuring the application to run automatically at Windows startup.

After the installation routine is completed, a message indicating success or failure of the program installation will appear. Once the WJ-871Y/PCSM2 software is successfully installed, Windows must be restarted to ensure that all changes in configuration take effect.

**G.3.3 FIELD INSTALLATION PROCEDURE FOR TYPE 797201-3 DIGITAL EXPANSION ASSEMBLY**

Installation of the Type 797201-3 Digital Expansion Assembly consists of mounting the daughterboard onto the receiver's Digital assembly. All of the necessary installation hardware is included with the option. The installation procedure is detailed in the following steps.

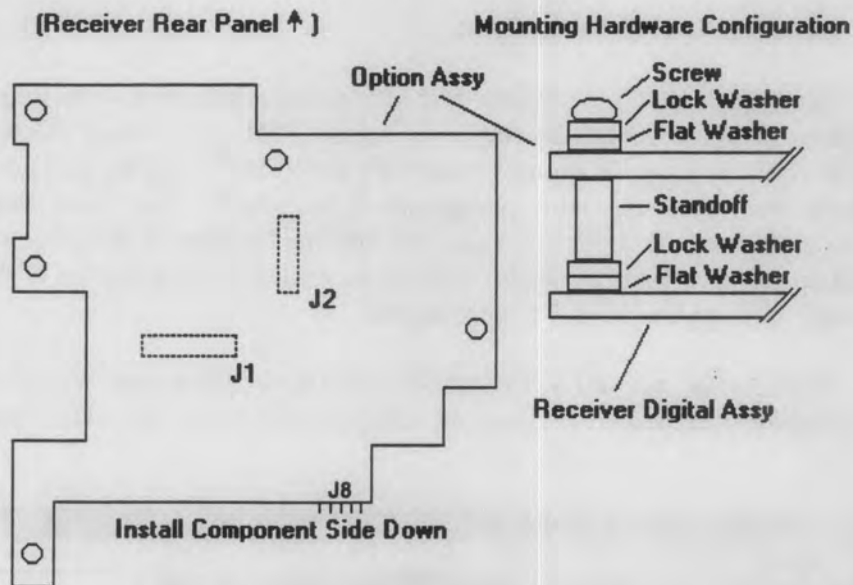
1. Remove the top cover from the receiver to gain access to the receiver's Digital Control Assembly (A2).
2. Remove five of the six mounting screws and their associated washers from the Digital Assembly, identified as items 1 through 5 in **Figure G-6**.



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**Figure G-6. Mounting Hardware Illustration**

3. At each mounting location install one standoff, one flat washer, and one lock washer. Refer to the Mounting Hardware Configuration in **Figure G-6** for the orientation of these parts.
4. Orient the Type 797201-3 Digital Expansion Assembly as illustrated in **Figure G-7**, with the component side facing down and J8 pointing toward the front of the receiver. Carefully connect sockets J1 and J2 with J8 and J9 on the Digital Control Assembly (A2). Using slight pressure, seat the Digital Expansion Assembly into place.
5. At each of the five mounting holes on the Type 797201-3 Digital Expansion Assembly, install one mounting screw, one flat washer and one lock washer. Refer to the mounting hardware configuration in **Figure G-7** for the orientation of these parts.



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**Figure G-7. Type 797201-3 Digital Expansion Assembly Hardware Illustration**

6. On the rear panel of the receiver, locate the existing 9-pin D-type "knock-out" that is directly above connector A2J3 (refer to **Figure G-4**). Carefully remove and discard the "knock-out", taking care not to damage any receiver connectors or assemblies.
7. Install option cable W1 (supplied with the WJ-871Y/PCSM2 Option) as follows:
  - Mount connector W1J1 to the rear panel of the receiver using the provided hardware: WJ Part Number 205817-1, Screw/Lock Kit. Affix the supplied label, "PCSM2", next to this connector as shown in **Figure G-4**.
  - Connect W1P1 to A2J8 of the receiver's Digital Control Assembly.
8. Replace the receiver's top cover.

G.4

**OPERATION**

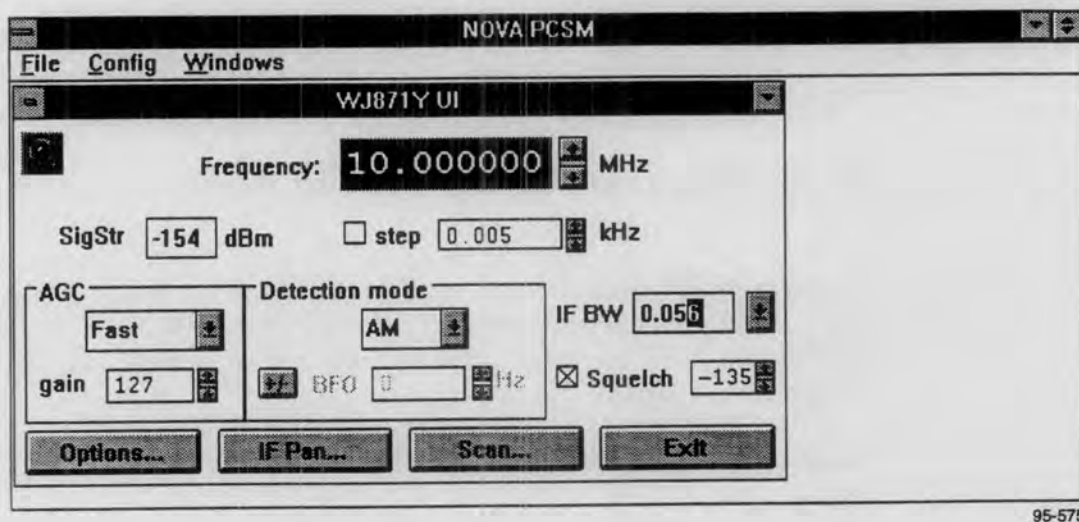
Performing receiver operations with the WJ-871Y/PCSM2 Control and Monitoring Application software requires the user to start the program, configure the receiver, and select an operation mode. The following paragraphs provide information on these and other operational functions.



### G.4.1 STARTING THE PROGRAM

The WJ-871Y/PCSM2 Control and Monitoring Application software must be run from within Microsoft® Windows. Windows can be started by typing WIN and pressing <Enter>. From the Program Manager desktop, open the program group labeled "WJ CONTROL". (This assumes the default installation configuration parameters were selected in **paragraph G.3.2**, step 6.) Two icons should be displayed in the group box -- one for starting the applications program and one for opening the read-me file. The read-me file contains any last minute program changes that may not be included in this version of the manual. To open the read-me file, double-click on the WJ-871Y notepad icon.

Double-click the WJ-871Y/PCSM2 icon to initialize the WJ-871Y/PCSM2 Control and Monitoring Application program. The program automatically enters the Main control window shown in **Figure G-8**.



**Figure G-8. The Main Control Window**

During the initialization routine, the program learns the receiver's configuration. The receiver powers up to the same configuration that was set prior to the last power-down.

## G.4.2 EXITING THE PROGRAM

The WJ-871Y/PCSM2 Control and Monitoring Applications program is exited by selecting the Exit button located in the lower right corner of the Main control window or by selecting the **E**xit menu item from the **F**ile menu (refer to **Figure G-9**). The program can also be exited by using the <ALT F4> hot-key combination within the application window (refer to **paragraph G.4.3.3**). This returns control to the Windows program.



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**Figure G-9. Exiting the Applications Program**

## G.4.3 GENERAL WINDOWS FEATURES

The WJ-871Y/PCSM2 Control and Monitoring Application is a Windows-type program that uses the same general window features, such as menus and windows, found in other commercial Windows programs. The following paragraphs provide an overview of the general features.

### G.4.3.1 Basic Window Structure

**Figure G-10** is an example of a window provided in the Applications Program. Every window has some common elements; however, not all windows use all the elements. The common window elements are: the control menu button, the title bar, the scroll bar, the maximize and minimize buttons, the data area, the mouse pointer, and the hot-key identifiers.

The control menu button is located in the upper-left corner of each window. This menu is useful if using a keyboard is preferred when working with the windows. Control menu commands are available for restoring, moving, resizing, minimizing, maximizing, and closing windows. Refer to **paragraph G.4.3.5.3** for more information on using the control menu.

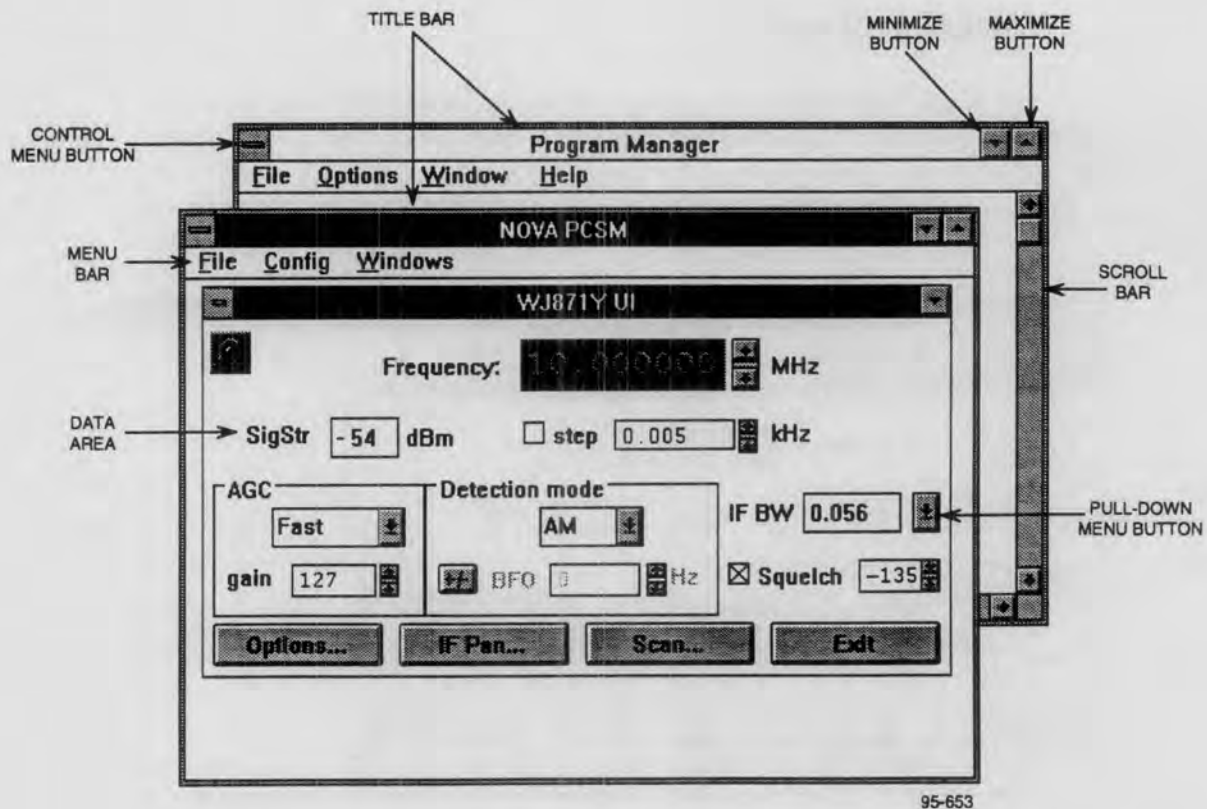


Figure G-10. Basic Components of a Window

The title bar shows the name of the window. If more than one window is open at one time, the background of the title bar for the active window is dark with the letters of the title being light. The title bars for inactive windows have gray-shade backgrounds with dark title letters.

The menu bar lists the available menus and options for the window. Hot-keys are identified as underlined letters in each menu title.

The scroll bar allows for scrolling through the contents of a window when the entire window cannot be displayed at once. Refer to **paragraph G.4.3.7.3** for more information on using the scroll bar.

The maximize and minimize buttons can be used to enlarge the active window to fill the entire desktop or shrink the window to an icon. After a window is enlarged with the maximize button the function of the button changes to the restore button. The restore button can be used to return the window to its original size. Refer to **paragraph G.4.3.7.1** for more information on changing the size of a window.

The data area contains the data elements of the window. Some fields in the data area can be edited while others are read-only. Pull-down menu buttons are displayed in certain edit fields, allowing the user to select a new value for the edit field by simply clicking the button instead of accessing items from the menu bar.

An arrow-shaped mouse pointer appears if a mouse is installed. The pointer is used to indicate items to be selected or chosen with the mouse.

#### G.4.3.2 Mouse Control

A mouse is required when running the WJ-871Y/PCSM2 Control and Monitoring Applications software. When a mouse is installed, an arrow-shaped pointer is present on the screen. Moving and clicking the mouse can move and resize windows and can select menus, menu items, buttons, and data fields.

Menus can be opened by placing the mouse pointer over the menu name in the menu bar of the window and clicking the left mouse button. Menu items can be selected by clicking the left mouse button over the desired menu item.

Buttons in windows, such as the MINIMIZE and MAXIMIZE buttons or decision buttons such as OK and CANCEL, can be activated by placing the mouse pointer over the button and pressing the left mouse button.

Windows can be moved by first placing the mouse pointer over the title bar of the window, then holding the left mouse button and dragging the window to the desired location.

#### G.4.3.3 Keyboard Control

Menu items available from the Menu Bar of the WJ-871Y/PCSM2 applications program may be accessed via the keyboard if desired. As seen in the menu bar of the window in **Figure G-10**, each menu item has an underlined letter. These are referred to as hot-keys. Hot-keys are used in conjunction with the ALT key to select the menus. For example, to select the File menu, press and hold the ALT key. Then, while holding the ALT key, press the "F" key. Several function keys can be used to facilitate working with the Application window as defined below:

<ALT Spacebar>	Open Control Menu
<ALT Spacebar S>	Sizes Application Window
<ALT F4>	Exits Application

#### G.4.3.4 Operator Input Error Audible Beep

An audible beep is sounded when an invalid operator action has occurred. When the beep is sounded, the operator action is ignored and control is returned to wherever the invalid action was attempted.

#### G.4.3.5 Working With Menus

All commands for the Applications Program are listed in menus. The Applications Program contains a Main menu that is accessed as soon as the program is entered. This menu is always present at the top of the display. A control menu, or system menu, opens from a small box in the upper-left corner of all windows. Other menus are represented by names in the menu bar at the top of each window. The following paragraphs provide further details on working with menus.

#### G.4.3.5.1 **Selecting and Canceling Menus**

A menu can be selected and opened with a mouse by placing the mouse pointer over the menu name in the menu bar and then pressing the left mouse button.

A menu in an active window can be selected and opened with the keyboard by either of two ways: by simply typing the menu name's hot-key identifier while holding the ALT key, or by using the left or right arrow key to highlight the menu name and then pressing the ENTER key or the down arrow key.

To cancel a menu with a mouse, place the mouse pointer anywhere outside the menu and click the left mouse button. To cancel with the keyboard, press the ESC (escape) key.

#### G.4.3.5.2 **Choosing Menu Items**

A menu item in a selected menu can be chosen with the mouse by simply clicking on the menu item. Choosing a menu item with the keyboard involves using the up or down arrow keys until the menu item is selected and then press the ENTER key.

Menu items that access sub-menus are indicated by a right arrow (▶). Choosing such a menu item automatically displays the corresponding sub-menu. Sub-menu items are selected in the same way that other menu items are selected.

The text of some menu items may appear lighter in intensity than others, depending on the menu accessed. A lighter intensity menu item indicates that it cannot be selected under the current setup or conditions.

#### G.4.3.5.3 **Using the Control Menu**

A control menu, or system menu as referred to in some windows programs, is accessible from all control windows. This menu provides access to general window control functions such as minimizing windows, maximizing windows, restoring windows to their original size, moving windows, and closing windows.

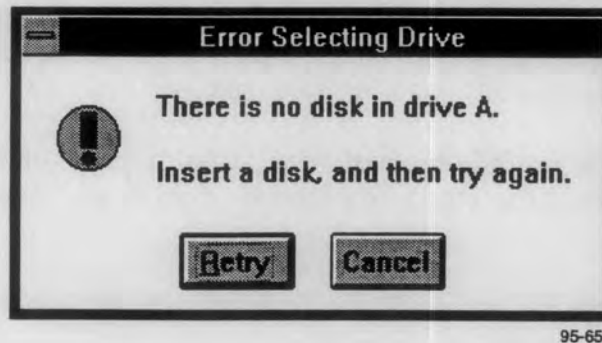
The control menu can be accessed by clicking on the control menu button with the mouse (refer to **Figure G-10**). Or, it can be accessed with the keyboard by pressing the spacebar while holding down the ALT key.

#### G.4.3.6 **Pop-Up Windows**

Several pop-up windows are available which are automatically activated and displayed to alert the operator of certain conditions or decisions when situations occur. These pop-up windows (Error, Confirmation, and Messages) are further described in the following paragraphs.

#### G.4.3.6.1 The Error Pop-Up Window

The Error pop-up window (refer to **Figure G-11**) is provided to alert the operator when an error has occurred. The error will generally be explained in the data area of the window to aid the operator to determine the error. No other windows can be accessed while the Error window is displayed. The error can be cleared and the window closed by selecting the appropriate button in the window. If the error persists, the Error window will be redisplayed.



**Figure G-11. Example of the Error Pop-Up Window**

#### G.4.3.6.2 The Confirmation Window

Certain operator actions which require a simple yes/no decision to be made cause the Confirmation pop-up window to open. This window is provided to allow the operator to confirm that the action taken in the window is necessary or wanted. Messages are displayed in the window such as "Overwrite Existing Files?". Types of actions causing the Confirmation pop-up window to open are those such as overwriting or deleting files, clearing scan setups, etc. To confirm the decision and the action, select the ACCEPT or OK button in the pop-up window. Confirmation can also be made by pressing the ENTER key. To abort the action select the CANCEL button. Canceling can also be done by pressing the ESC key. Canceling returns control back to the active window.

#### G.4.3.6.3 The Messages Pop-Up Window

The Messages window provides a dialog box which is used to alert the operator to something that has occurred on the system.

### G.4.3.7 Working With A Window

The following paragraphs provide details on the general control of windows.

#### G.4.3.7.1 **Changing the Size of a Window**

The size of a window can be changed to accommodate the room available on the desktop. A window can be stretched with the mouse by clicking on a window corner or border and dragging until the desired size is displayed. When using a keyboard, the window size can be changed by first accessing the window's control menu (<ALT><spacebar>) and selecting the Size menu item. Using the left or right arrow keys stretches the window horizontally and using the up and down arrow keys stretches it vertically.

The window can also be maximized to full display size or minimized to icon size. To maximize the window with a mouse, click on the maximize button (▲). To minimize the window click on the minimize button (▼).

To maximize a window with the keyboard, open the window's control menu and select the Maximize menu item. To minimize it select the Minimize menu item.

To restore the window back to its pre-minimized or pre-maximized size, access the window's control menu and select the Restore menu item.

#### G.4.3.7.2 **Moving Windows, Window Icons, and Pop-Up Windows**

A window can be moved with the mouse by first placing the mouse pointer over the title bar of the window, then holding down the left mouse button and dragging the window to the desired location.

An active open window can also be moved with the keyboard. This is done by first opening the window's control menu and selecting the Move menu item. The window can then be moved in any direction on the display with the up, down, left, and right arrow keys. Once the window is at the desired location, press the Enter key to exit the move function.

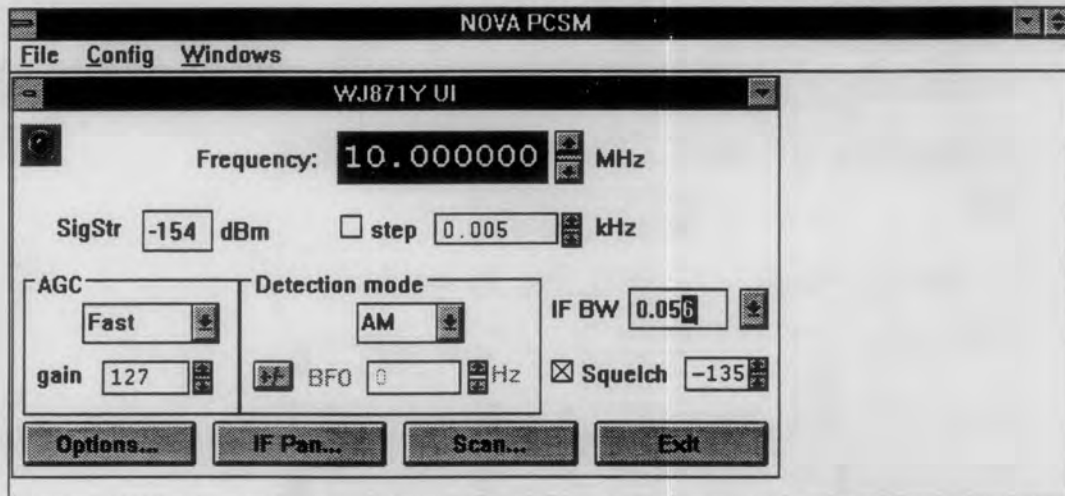
#### G.4.3.7.3 **Using the Scroll Bars**

Some windows provided in the program, especially those that contain lists, have scroll bars (refer to **Figure G-10**). These are convenient for scrolling through lists of data to more easily reach the desired information. Each scroll bar has a scroll-down button, a scroll-up button, and a scroll box. Clicking once on the scroll-down button scrolls the list down by one line. Clicking and holding the mouse button down on the scroll-down button continues scrolling down through the list until the last line is reached. The scroll-up button works identically except it scrolls up through the list.

The scroll box is used for fast scrolling. The location of the box in the scroll bar indicates the general position in the list that the current displayed lines are located. The scroll box can be moved by clicking and dragging it up or down the scroll bar. Dragging up scrolls up through the list and dragging down scrolls down. When the box is at the top of the scroll bar, the top of the list is displayed. When at the bottom of the scroll bar, the bottom of the list is displayed.

G.4.4 RECEIVER CONTROL FUNCTIONS

Control of the WJ-871Y receiver can be accessed via the WJ-871Y/PCSM2 software's graphic user interface (GUI). **Figure G-12** shows the Main NOVA PCSM Display Window and the active default window (WJ871Y UI). Both windows are entered when the WJ-871Y/PCSM2 applications program is initiated. **Table G-1** lists the receiver commands available from the Main NOVA PCSM and the WJ871Y UI display windows.



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Figure G-12. The Main NOVA PCSM Display Window

Table G-1. List of NOVA PCSM Control Functions

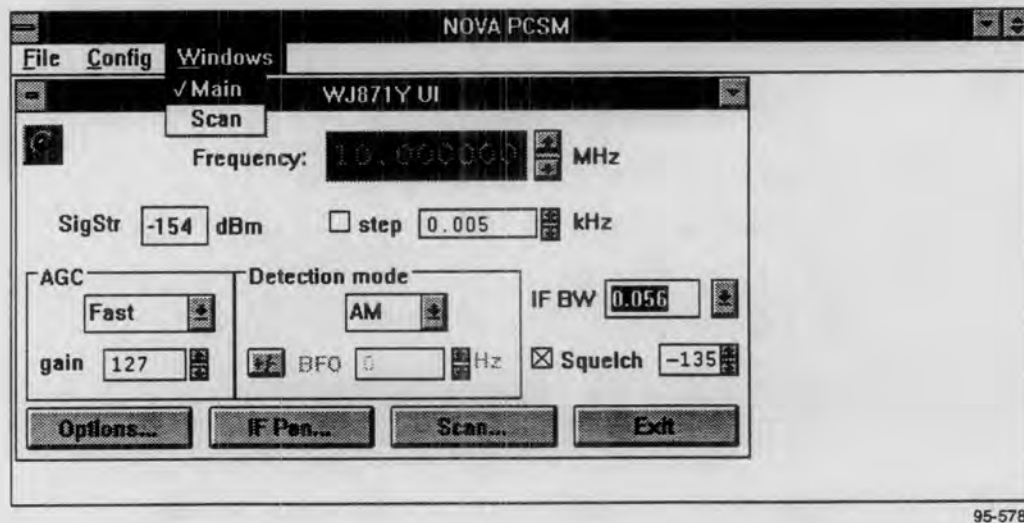
Control Function	Description	Paragraph Ref.
Window Selection	Selects active control window, Main or Scan	G.4.4.1
Options	Selects PC COM port	G.4.4.2
Receiver Configuration	RF Input Path	G.4.4.3
Local/Remote Control	Selects local, remote, or remote with local lockout	G.4.4.4
Frequency	Sets the receiver's tuned frequency	G.4.4.5
Step Control	Enables/disables the operator selected step tune size	G.4.4.6
Signal Strength	Displays Signal Strength	G.4.4.7
AGC	Selects Manual/Automatic Gain Control	G.4.4.8
Detection Mode	Selects receiver detection mode AM/SAM/CW/FM/USB/LSB/ISB	G.4.4.9
BFO	Sets the BFO frequency	G.4.4.9.1
IF Bandwidth	Selects the Receiver IF Bandwidth, 66 filters are available	G.4.4.10
Squelch	Selects On/Off and level	G.4.4.11
IF Pan	Opens IF Pan display	G.4.4.12
Scan	Activates frequency Scan window	G.4.4.13

The functions listed in **Table G-1** are described in detail in the following paragraphs.



#### G.4.4.1 Activating WJ-871Y/PCSM2 Control Windows

There are two control windows associated with the WJ-871Y/PCSM2 Control software: the WJ871Y UI control window and the Scan control window. These windows are accessed via the Windows pull-down menu of the Main NOVA PCSM window. To open the Windows pull-down menu, select the Windows menu item from the Menu Bar with the left mouse button. This opens the pull-down menu shown in **Figure G-13**.



**Figure G-13. The Windows Pull-Down Menu**

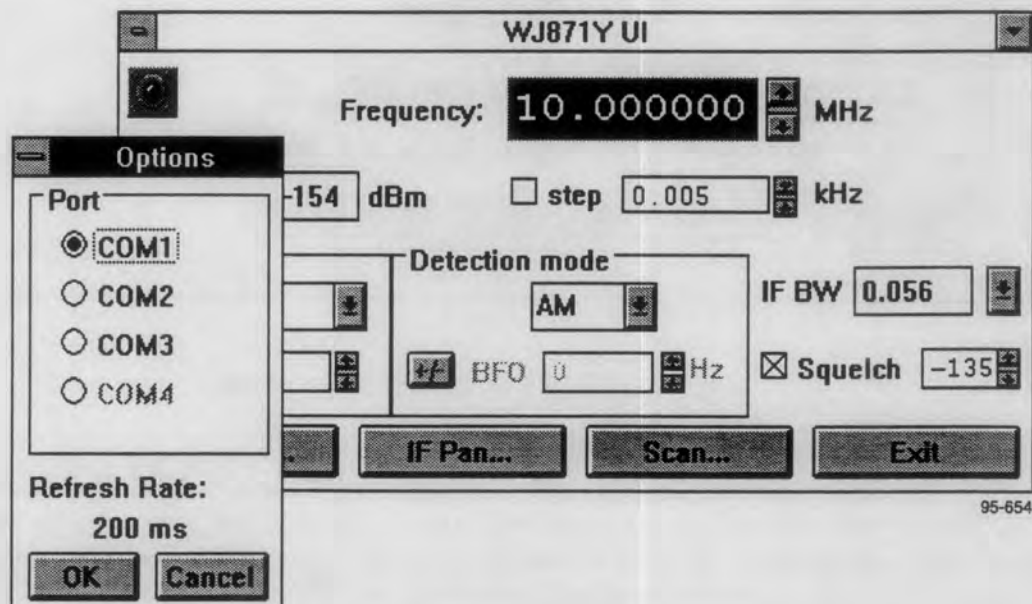
Two selections, Main and Scan, are provided in the Windows pull-down menu. The currently active control window is identified by a check mark to the left side of the menu item.

Selecting the Main menu item activates the WJ-871Y UI control window shown in **Figure G-12**. This window is the default window for the WJ-871Y/PCSM2 applications program and provides access to receiver parameters used during manual receiver operations. Receiver parameters such as the control mode, tuned frequency, step tune size, gain control mode, detection mode, IF bandwidth, and squelch setting can be viewed or changed. Additionally, the Scan control window and the IF Pan display may be accessed from the WJ871Y UI (Main) control window. For further details on setting receiver parameters from the WJ871Y UI (Main) window refer to **paragraphs G.4.4.2 through G.4.4.11**. For information on the IF Pan display and the Scan control window, refer to **paragraphs G.4.4.12 and G.4.4.13**, respectively.

Selecting the Scan menu item from the Windows pull-down menu activates the Scan window. The Scan window permits placing the receiver in the scan operating mode. The scan mode allows the receiver to tune between identified start and stop frequencies at a predetermined tuning increment. For details on the Scan window and the scan mode of operation, refer to **paragraph G.4.4.13**.

#### G.4.4.2 Selecting the Communications Port for RS-232 Control

The Options button, located in the lower left portion of the WJ871Y UI (Main) control window, is used to select the computer communications port for the RS-232 input signal from the receiver. Clicking on this button produces the Options window shown in **Figure G-14**.



**Figure G-14. The Options Window**

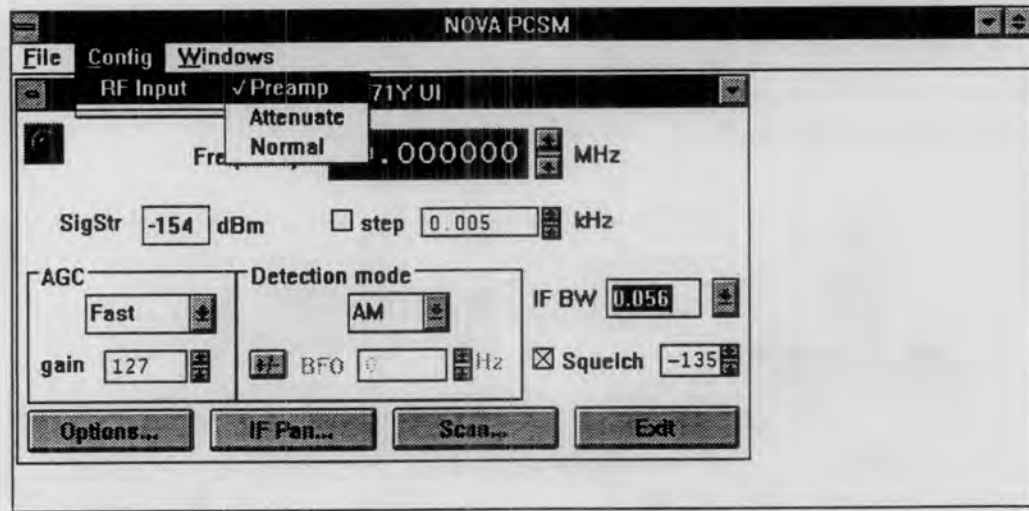
To select the communications port for the receiver, use the computer mouse to click on the desired selection. Confirm the selection by clicking on the Option window's OK button. Clicking on the Cancel button will result in no change to the COM port selection. The default COM port for the WJ-871Y/PCSM2 software is COM2. COM4 is not available for selection.

During receiver control via the WJ-871Y/PCSM2 software, the receiver's front panel displays are updated at a rate of once every 200 mS. This "Refresh Rate" is displayed in the lower portion of the Options window. This field is read-only.

#### G.4.4.3 RF Input Path Selection

Three RF input path selections are available for the WJ-871Y receiver. These selections permit enabling the receiver's preamplifier, attenuator, or normal RF signal paths. The currently selected RF input path can be viewed or changed from the RF Input pull-down menu of the Main NOVA PCSM control window.

The RF Input pull-down menu is accessed by first selecting the Config menu item in the Menu Bar of the Main NOVA PCSM control window. This opens the Config pull-down menu consisting of one menu item: RF Input. Selecting the RF Input menu item opens the RF Input pull-down menu shown in **Figure G-15**.



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**Figure G-15. RF Input Pull-Down Menu**

The currently active RF Input path is identified by a check mark to the left side of the active setting. When Preamp is selected, the RF input to the receiver is amplified approximately 10 dB. Selecting Attenuate provides approximately 15 dB of attenuation to the RF input signal. When Normal is selected, the RF input signal is routed through its normal path without any amplification or attenuation. To change the RF Input path, select the appropriate menu item with the left mouse button. For further information on the Preamp, Attenuate, and Normal selections refer to **Section III** in the WJ-871Y base manual.

#### G.4.4.4 Selecting the Local/Remote Control Modes

Refer to **Figure G-12**. Located in the upper left corner of the WJ871Y UI (Main) control window (just below the Control Menu Button) is a simulated indicator light. Clicking on this icon toggles the receiver through three available control modes:

- **Local** - The simulated light turns black and the word **Local** appears momentarily to the right of the icon. In this state the receiver is controlled via its front panel. No receiver functions can be controlled via the WJ-871Y/PCSM2 control software except to place the receiver to the remote control mode.
- **Remote** - The simulated light turns red and the word **Remote** appears momentarily to the right of the icon. In this state the receiver can be controlled from either the remote computer or from its front panel.
- **Locked** - The simulated light remains red and the word **Locked** appears momentarily to the right of the icon. In this state, the receiver front panel is locked out. The receiver can be controlled **ONLY** from the remote computer.

#### G.4.4.5 Entering the Tuned Frequency

Refer to **Figure G-12**. The Frequency window, located in the upper center portion of the WJ871Y UI (Main) control window, permits the adjustment and viewing of the receiver's current tuned frequency. The tuned frequency range is from 0.0 Hz to 30.0 MHz, with a 1.0 Hz tuning resolution. Adjustment of the tuned frequency can be accomplished using one of the following methods:

- Using the computer mouse, double-click on the Frequency window and type in the desired frequency with the controller's numeric keypad. Press the **Enter** key when completed.
- Use the computer mouse to place the display cursor next to a digit in the Frequency window, identifying the desired tuning resolution. Once the tuning resolution is selected, click on the up or down arrow buttons to the right of the Frequency window. The displayed digit to the left side of the display cursor will increment or decrement by a value of one as the up or down arrow buttons are selected, respectively.
- Activate the Step Tune function for the receiver and use the frequency display's up/down arrow buttons to increment or decrement the tuned frequency by the selected step tune size. Refer to **paragraph G.4.4.6** for details concerning the Step Tune function.

#### G.4.4.6 Using the Step Tune Function

Refer to **Figure G-12**. The Step tune function allows the tuned frequency of the receiver to be adjusted according to an operator selected step tune size. The range for the step tune size is from .001 kHz to 30.0 kHz, with a 1.0 Hz resolution. The step tune function is implemented using the step window and the step selection box located directly below the Frequency window. The desired step size can be entered in the following ways:

- Using the computer mouse, double-click on the step window and type in the desired step tune size with the controller's numeric keypad. Press the **Enter** key when completed.
- Use the computer mouse to place the display cursor next to a digit in the step window, identifying the desired adjustment resolution. Once the resolution is selected, click on the up or down arrow buttons to the right of the step window. The displayed digit to the left side of the display cursor will increment or decrement by a value of one as the up or down arrow buttons are selected, respectively.

Once the desired step tune size is entered, enable the step tune function by clicking on the box next to the word 'step' with the mouse cursor. When enabled, an 'x' appears in the step box. When the step tune mode is enabled, the up and down arrow buttons of the Frequency window are used to increment or decrement the tuned frequency according to the entered step tune value.

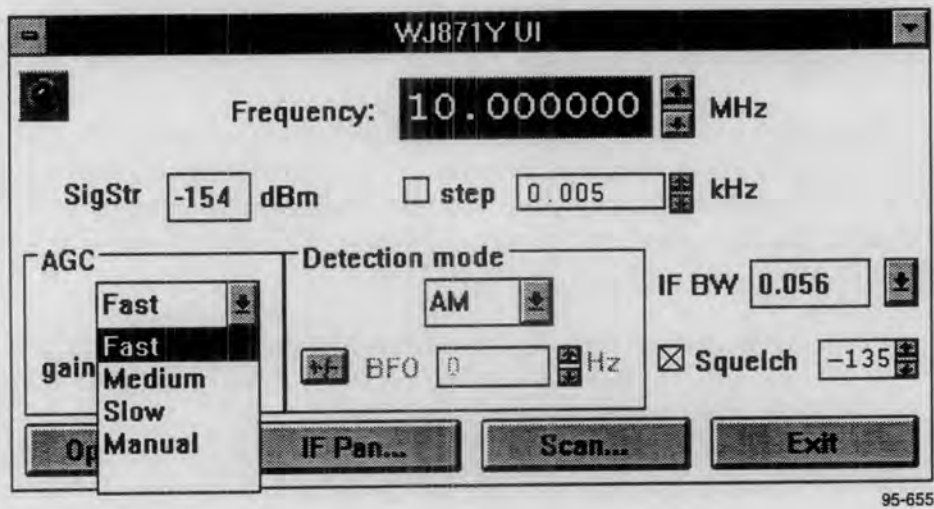
**G.4.4.7 Viewing the Received Signal Strength**

Refer to **Figure G-12**. The "SigStr" field, located on the left side of the WJ871Y UI (Main) window, identifies the signal strength in dBm of the RF signal being detected by the receiver. This is an informational field only.

**G.4.4.8 Setting the Gain Control Mode**

Refer to **Figure G-12**. The AGC field, located in the lower left portion of the WJ871Y UI (Main) window, is used to select the gain control mode of the receiver. Available modes are Automatic Gain Control (AGC) and Manual. In the AGC mode, the receiver automatically adjusts the gain level (depending on the level of the received signal) to provide the optimum signal level for demodulation. Three AGC settings are available including AGC Fast, AGC Medium, and AGC Slow. The AGC Fast mode is a more suitable selection for AM and FM detection modes, while the AGC Medium and AGC Slow modes are suitable for CW, USB, LSB, and ISB detection modes. In the Manual gain mode, the gain level of the receiver is set manually between 0 and 127 dB, in 1.0 dB increments. For further details on the AGC and Manual gain modes, refer to **Section III** of the WJ-871Y base manual.

To select the current gain control mode, click the mouse cursor on the AGC pull-down menu button. This opens the AGC pull-down menu shown in **Figure G-16**. Select the desired gain control mode by placing the mouse cursor on the required AGC mode or the Manual selection and click the left mouse button. The current gain mode is displayed in the AGC field to the left of the pull-down menu button.



**Figure G-16. The AGC Pull-Down Menu**

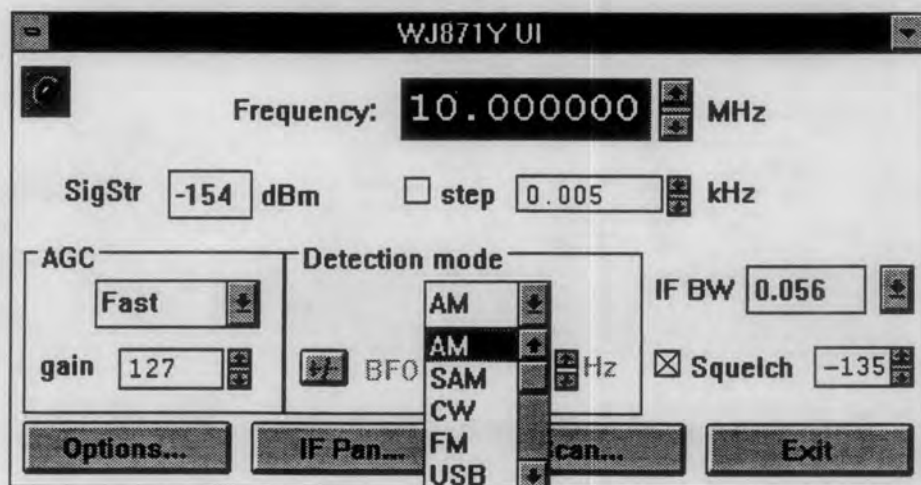
Regardless of the selected gain control mode, the manual gain level is displayed in the lower portion of the AGC field below the AGC pull-down window. The manual window is only active, however, when the Manual gain control mode is selected. To adjust the manual gain value, double-click on the gain window with the mouse and type in the desired level, in dB, with the controller's numeric keypad. Press the **Enter** key when completed. An alternate method of adjustment is to click the mouse cursor on the up or down

arrow buttons of the gain window. Each press of the up or down arrow buttons increments or decrements the gain setting by a value of one, respectively.

#### G.4.4.9 Selecting the Detection Mode

Refer to **Figure G-12**. The Detection mode field, located in the lower center portion of the WJ871Y UI (Main) window, is used to select the current detection mode of the receiver. Available detection modes are AM, Synchronous AM, CW, FM, USB, LSB, and ISB. The current detection mode is displayed in the upper portion of the Detection mode field. While in the CW detection mode, a Beat-Frequency-Oscillator (BFO) is available (refer to **paragraph G.4.4.9.1** for details).

To change the detection mode selection, open the detection mode pull-down menu by clicking on the detection mode pull-down menu button. Once the detection mode pull-down menu is open (refer to **Figure G-17**) select the desired detection mode with the computer's mouse. After the selection is made, the pull-down menu is closed and the detection mode window is updated to show the current selection.



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**Figure G-17. The Detection Mode Pull-Down Menu**

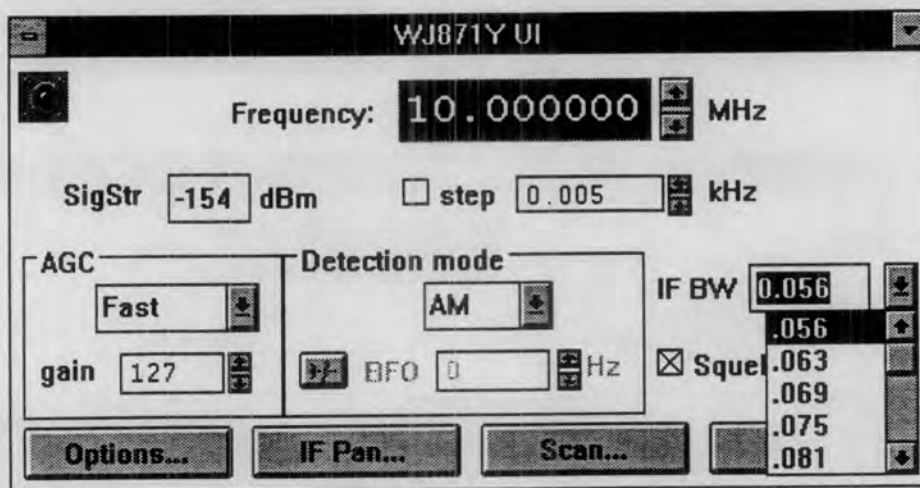
#### G.4.4.9.1 Adjusting the BFO Frequency

While in the CW detection mode, a BFO is available to aid in the reception of CW signals. The BFO range is +/-8000 Hz, with a 10.0 Hz resolution. The current BFO setting is displayed in the BFO window located in the lower portion of the Detection mode field (refer to **Figure G-12**). To adjust the BFO setting, double-click on the BFO window with the mouse and type in the desired frequency with the controller's numeric keypad. Press the **Enter** key when completed. An alternate method of adjustment is to click the mouse cursor on the up or down arrow buttons of the BFO window. Each press of the up or down arrow buttons increments or decrements the BFO setting by a value of 10 Hz, respectively. In all detection modes other than CW, the BFO window is disabled.

The "+/-" button, located at the left side of the BFO window, is used to quickly change the polarity of the BFO setting. Each click of the "+/-" button toggles the selected BFO frequency between plus, minus, and 0 Hz. For example, if the current BFO frequency is +1000 Hz, the BFO setting will toggle between -1000 Hz, 0.0 Hz, and +1000 Hz with each press of the "+/-" button.

**G.4.4.10 Selecting an IF Bandwidth**

Refer to **Figure G-12**. The IF BW field, located in the lower right portion of the WJ871Y UI (Main) window, is used to select the receiver's IF bandwidth filter selection. One of 66 different IF bandwidths, ranging from .056 kHz to 16.0 kHz, are available for selection from the IF BW pull-down menu shown in **Figure G-18**. **Table G-2** lists the available IF bandwidth filter choices.



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**Figure G-18. The IF Bandwidth Pull-Down Menu**

To select an IF bandwidth filter, click the mouse cursor on the pull-down menu button of the IF BW window. A pull-down menu appears showing the available bandwidths (refer to **Figure G-18**). Using the pull-down menu's scroll bar, scroll through the IF bandwidth list and click on the desired bandwidth. The pull-down menu will close and the selected IF bandwidth value appears in the IF BW window.

**Table G-2. Available IF Bandwidth Filters**

IF Bandwidths: .....	3 dB Bandwidths	Typical Shape Factor (3/60 dB)	3 dB Bandwidths	Typical Shape Factor (3/60 dB)
	.056 kHz	1.45:1	1.000 kHz	1.40:1
	.063 kHz	1.40:1	1.100 kHz	1.40:1
	.069 kHz	1.40:1	1.120 kHz	1.35:1
	.075 kHz	1.35:1	1.300 kHz	1.35:1
	.081 kHz	1.35:1	1.400 kHz	1.35:1
	.088 kHz	1.35:1	1.500 kHz	1.35:1
	.094 kHz	1.35:1	1.600 kHz	1.30:1
	.100 kHz	1.30:1	1.800 kHz	1.45:1
	.113 kHz	1.45:1	2.000 kHz	1.40:1
	.125 kHz	1.40:1	2.200 kHz	1.40:1
	.138 kHz	1.40:1	2.400 kHz	1.35:1
	.150 kHz	1.35:1	2.600 kHz	1.35:1
	.163 kHz	1.35:1	2.800 kHz	1.35:1
	.175 kHz	1.35:1	3.000 kHz	1.35:1
	.188 kHz	1.35:1	3.200 kHz	1.30:1
	.200 kHz	1.30:1	3.600 kHz	1.45:1
	.225 kHz	1.45:1	4.000 kHz	1.40:1
	.250 kHz	1.40:1	4.400 kHz	1.40:1
	.275 kHz	1.40:1	4.800 kHz	1.35:1
	.300 kHz	1.35:1	5.200 kHz	1.35:1
	.325 kHz	1.35:1	5.600 kHz	1.35:1
	.350 kHz	1.35:1	6.000 kHz	1.35:1
	.375 kHz	1.35:1	6.400 kHz	1.30:1
	.400 kHz	1.30:1	7.200 kHz	1.45:1
	.450 kHz	1.45:1	8.000 kHz	1.40:1
	.500 kHz	1.40:1	8.800 kHz	1.40:1
	.550 kHz	1.40:1	9.600 kHz	1.35:1
	.600 kHz	1.35:1	10.400 kHz	1.35:1
	.650 kHz	1.35:1	11.200 kHz	1.35:1
	.700 kHz	1.35:1	12.000 kHz	1.35:1
	.750 kHz	1.35:1	12.800 kHz	1.30:1
	.800 kHz	1.30:1	14.400 kHz	1.25:1
	.900 kHz	1.45:1	16.000 kHz	1.20:1



#### G.4.4.11 Setting the Squelch Value

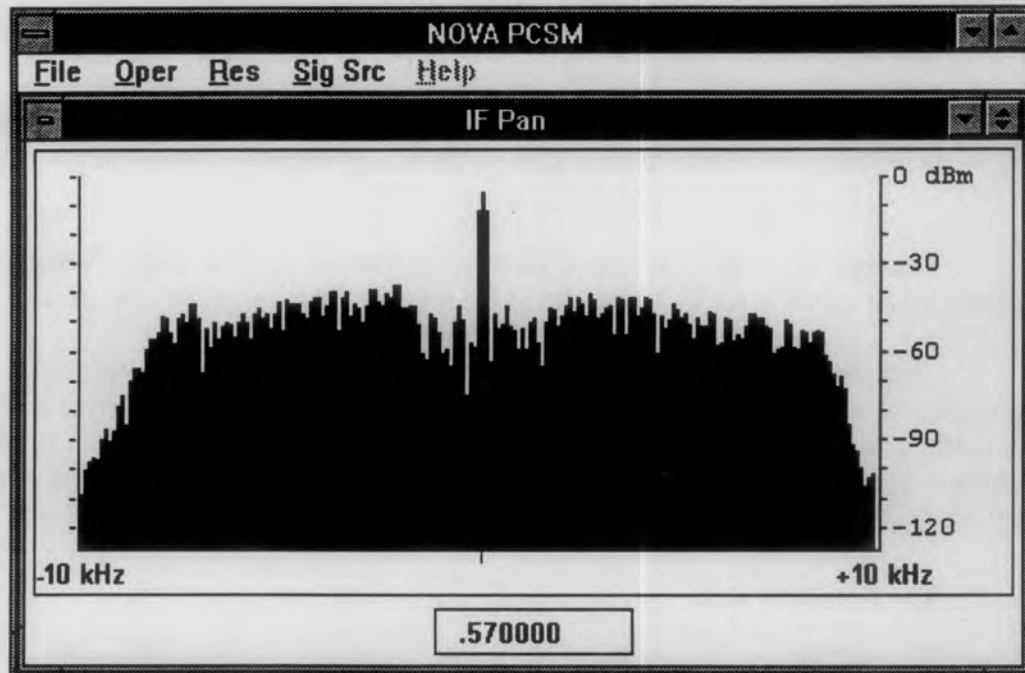
The squelch control function is used to limit unwanted signals or noise below a selected threshold level. If a signal is being received that is not quite strong enough for proper demodulation (i.e., audio is unclear), the squelch level can be adjusted to block it from being applied to the receiver's audio outputs. The squelch control function is located in the lower right portion of the WJ871Y UI (Main) control menu (refer to **Figure G-12**). The squelch mode may be enabled by clicking on the box to the left of 'Squelch.' An 'x' will appear in the box indicating that squelch is enabled. To disable squelch, click again on the box and the 'x' will disappear indicating that squelch is off.

When squelch is enabled, the available squelch range is from 0 and -135 dBm. The squelch level may be set by using one of the following methods:

- Using the computer mouse, double-click on the Squelch window and type in the desired squelch value in -dBm with the controller's numeric keypad. Press the **Enter** key when completed.
- Click on the up or down arrow buttons on the right side of the Squelch window. Each press of the up or down arrow buttons increases or decreases the squelch setting by a value of 1 dB, respectively.

#### G.4.4.12 Viewing the IF Pan Display

The IF Pan button, located in the lower left portion of the WJ871Y UI (Main) control window, permits access to the graphic IF Panoramic (IF Pan) display shown in **Figure G-19**.



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**Figure G-19. The IF Pan Display**

The current tuned frequency of the receiver is displayed in a box at the bottom center of the IF Pan display. The signal strength of the displayed signal is determined by referencing the display's right vertical axis (0 to -130 dBm). The tuned or center frequency of the IF Pan display can be changed by placing the mouse pointer to the left or the right of the display and clicking the left mouse button. If the pointer is on the left side of the display, the tuned frequency will shift downward with each click. If the pointer is on the right side of the display, clicking the left mouse button will cause the center frequency to shift upward. Placing the mouse pointer on a signal peak and clicking will cause the center frequency to shift to the frequency of that peak.

There are five menu items shown in the menu bar of the IF Pan window. They are:

- **File** - Allows storing an IF Pan display to a file.
- **Oper** - Provides Center display and Freeze display options.
- **Res** - Provides adjustment of the displayed bandwidth for the IF Pan display.
- **Sig Src** - Permits selection of the signal source for the IF Pan display.
- **Help** - Reserved for future enhancement.

The following paragraphs provide details on the menu items available in the IF Pan window.

#### G.4.4.12.1 The Oper Menu Item

Selecting the Oper menu item on the IF Pan display's menu bar opens the Oper pull-down menu. This menu provides two items for the control of the IF Pan display. The two menu items are Peak and Freeze.

Selecting the Peak menu item in the Oper pull-down menu causes the IF Pan display to center on the strongest signal shown in the IF Pan display at the time the Peak menu item was selected.

Selecting the Freeze menu item in the Oper pull-down menu causes the IF Pan display to freeze and not accept new data. This permits the IF Pan display to be analyzed. When the IF Pan display is in the Freeze mode, a check mark will appear to the left side of the Freeze menu item. To return the IF Pan display to normal operations, deselect the Freeze function by selecting the Freeze menu item with the mouse. The check mark next to the Freeze menu item is removed.

#### G.4.4.12.2 The Res Menu Item

Selecting the Res menu item on the IF Pan window menu bar opens the Res pull-down menu. This menu provides eight resolution options ranging from 156 Hz to 20.0 kHz. The selected resolution determines the current display bandwidth for the IF Pan window. **Table G-3** lists the available Res menu item values and the IF Pan window display bandwidths selected with each menu item.

**Table G-3. Resolution Value Versus IF Pan Display Bandwidth**

Selected Resolution Value	IF Pan Bandwidth (+/- From Center Frequency)
156 Hz	+/-78 Hz
312 Hz	+/-156 Hz
625 Hz	+/-312 Hz
1.25 kHz	+/-625 Hz
2.50 kHz	+/-1.25 kHz
5.00 kHz	+/-2.50 kHz
10.0 kHz	+/-5.00 kHz
20.0 kHz	+/-10.0 kHz

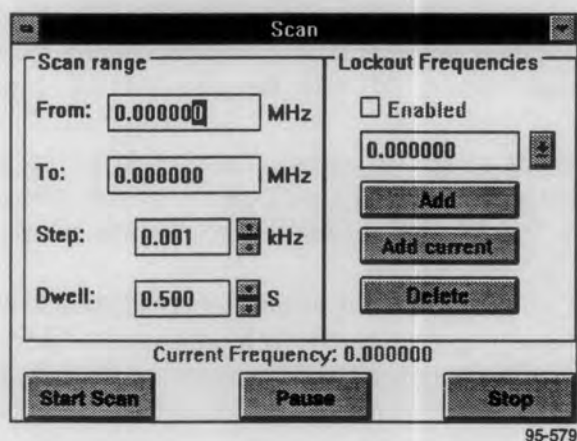
To change the display resolution, click the computer mouse on the desired resolution menu item. The display will update immediately with the new display resolution.

#### G.4.4.12.3 The Sig Scr Menu Item

The Sig Scr menu item of the IF Pan window menu bar provides two choices for use as the display's signal source. Available selections of 'Processed IF' and 'Unprocessed IF' are listed in the Sig Scr pull-down menu. To select the desired input source, use the computer mouse to click on the Sig Scr menu item, opening the Sig Scr pull-down menu. Select the desired signal source, 'Processed IF' or 'Unprocessed IF' with the mouse.

#### G.4.4.13 Opening the Scan Control Window

The Scan control window shown in **Figure G-20** is used to place the receiver into the scan mode of operation. The scan mode allows the receiver to automatically tune between defined start and stop frequencies at a predetermined step size. Once a signal is encountered whose signal strength is equal to or above the set threshold level, the scan process is suspended for a specified period of time. Additionally, the scan may be paused manually to continually monitor signals of interest.



**Figure G-20. The Scan Window**

There are two methods for opening the Scan window (refer to **Figure G-10**):

- 1) select the Scan menu item from the Windows pull-down menu of the Main NOVA PCSM window (refer to **paragraph G.4.4.1**),
- 2) select the Scan... button located in the lower center portion of the WJ871Y UI (Main) control window.

The following paragraphs provide details on setting the scan frequency range, the step size, and the signal dwell timer values. Information is also provided on starting, stopping, pausing, and resuming scan operations.

##### G.4.4.13.1 **Setting the Scan Frequency Range**

The Scan range control section appears on the left side of the Scan window (refer to **Figure G-20**). Two entry boxes labeled From and To are used to enter the scan's start and stop frequencies, respectively. Valid scan ranges may be entered between 0.0 Hz and 29.999999 MHz.

To enter a scan start frequency, select the From box with the mouse cursor and type in the desired start frequency with the controller's numeric keypad. Click the left mouse button to enter the selection when completed. Any frequency between 0.0 Hz and 29.999999 MHz is valid provided the start frequency is less than the entered stop frequency.

The scan stop frequency is entered in a similar manner. Select the To box with the mouse cursor and type in the desired stop frequency with the controller's numeric keypad. Click the left mouse button to enter the selection when completed. Any frequency between 0.0 Hz and 29.999999 MHz is valid provided the stop frequency is greater than the entered start frequency.

#### G.4.4.13.2 Setting the Scan Step Size

The Step box, located in the Scan range field of the Scan control window (refer to **Figure G-20**), is used to set the tuning increment used during the scan sequence. The step size can be set from .001 kHz to 25.0 kHz, with a resolution of .001 kHz. Three methods are available for entering the step size.

- Using the computer mouse, double-click on the Step box and type in the desired step size in kHz with the controller's numeric keypad. Click the left mouse button to enter the selection when completed.
- Click on the up or down arrow buttons adjacent to the Step box to change the displayed step size in .001 kHz increments. Each click of the up arrow or down arrow increments or decrements the step size, respectively.
- Use the computer mouse to place the cursor next to a digit in the Step box, identifying the desired adjustment resolution. Once the resolution is selected, click on the up or down arrow buttons adjacent to the Step box. The displayed digit to the left side of the display cursor will increment or decrement by a value of one as the up or down arrow keys are selected, respectively.

#### G.4.4.13.3 Setting the Signal Dwell Timer Value

The signal dwell timer is used to determine the amount of time the scan sequence is suspended when a signal is intercepted whose signal strength is equal to or greater than the set threshold level. Valid dwell timer settings are from 0.5 seconds to 20.000 seconds, with a resolution of .001 second. The dwell timer may be set to infinite by entering a value less than 0.5 seconds. Set the dwell timer by performing one of the following procedures (refer to **Figure G-20**):

- Using the computer mouse, double-click on the Dwell box and type in the desired dwell timer value with the controller's numeric keypad in seconds. Clicking the left mouse button enters the selection when completed.
- Click on the up or down arrow buttons adjacent to the Dwell box. Each click of the up or down arrow buttons increments or decrements the dwell timer value by .001 seconds, respectively.
- Use the computer mouse to place the cursor next to a digit in the Dwell box, identifying the desired adjustment resolution. Once the resolution is selected, click on the up or down arrow buttons adjacent to the Dwell box. The displayed digit to the left side of the display cursor will increment or decrement by a value of one as the up or down arrow buttons are selected, respectively.

#### G.4.4.13.4 Adding, Deleting, and Enabling Lockout Frequencies

The Lockout Frequencies display area located on the right side of the Scan control window (refer to **Figure G-20**) is currently inactive. Adding, deleting, and enabling lockout frequencies for a scan operation will be a future enhancement to the WJ-871Y/PCSM2 software control program.

#### G.4.4.13.5 Starting, Stopping, and Continuing A Scan

Refer to **Figure G-20**. Once all scan parameters are entered, click on the Start Scan button located in the lower left portion of the Scan window to start the scan sequence. Once the Start Scan button is selected, its function is changed to the Continue button.

To pause an active scan, click the Pause button located in the lower center portion of the Scan control window (refer to **Figure G-20**). This button suspends the scan sequence at the receiver's currently tuned frequency so that signals of interest may be monitored. To resume the scan sequence at the point from where it was paused, click the Continue button located in the lower left portion of the Scan control window.

To stop an active or paused scan operation, click the Stop button located in the lower right portion of the Scan control window (refer to **Figure G-20**).

### G.5 REPLACEMENT PARTS LIST

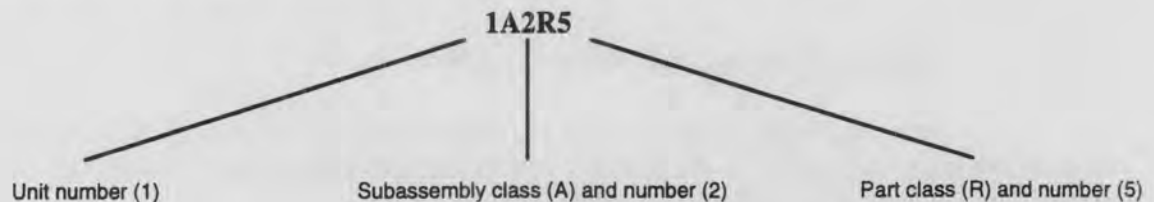
The following paragraphs provide comprehensive information on the parts used in the unit. Included is an overview of the method used to number the parts, a brief definition of the reference designator prefix, a list of applicable manufacturers including addresses, and the physical parts lists.

#### G.5.1 PART NUMBERING METHOD

The numbering method used to identify the parts used in this unit is consistent with most commercial and military numbering standards. Reference designations are assigned to assemblies, subassemblies, modules within a subassembly, and discrete components. These designations allow the user to quickly identify and locate specific parts, regardless of the complexity of the unit. A basic reference designation consists of a letter identifying the class (type) of the item followed by the item number. For example, the first resistor in an assembly is identified as "R1". Both complete and partial reference designations are found in this manual and throughout the unit.

**G.5.1.1 Complete Reference Designations**

A complete reference designation is used to identify a basic part along with each applicable unit and subassembly associated with the part. The unit and subassembly reference designations are listed as prefixes to the part's reference designation. For example, the following complete reference designation identifies the fifth resistor (R5) of the second subassembly (A2) in the first unit (1):



**G.5.1.2 Partial Reference Designations**

A partial reference designation, consisting only of the basic part's reference designator (e.g. R1), is used to identify each basic part in the replacement parts lists and schematic diagrams. The applicable unit and subassembly reference designation prefixes, which are not included in the actual partial reference designation, may be found at the beginning of each replacement parts list. Placing these reference designation prefixes before the basic part's partial reference designation yields the complete reference designation for the basic part.

On the main chassis schematic, components which are an integral part of the main chassis have no subassembly designations.

**G.5.2 LIST OF MANUFACTURERS**

The manufacturers listed below are supply sources used for obtaining certain parts in this option, and are not listed in the base manual. All other manufacturers not listed below can be found in the base manual.

<u>Mfr. Code</u>	<u>Name and Address</u>	<u>Mfr. Code</u>	<u>Name and Address</u>
86072	Capitol Radio Wholesales, Inc. 45 W. Watkins Mill Road Gaithersburg, MD 20878-4026	0FJN4	Arnet Corporation Digi International, Inc. 6400 Flying Cloud Drive Eden Parrie, MN 55344

**G.5.3 PARTS LIST**

The following parts lists contain the electrical components used in this unit, along with mechanical parts which may be subject to unusual wear or damage. Refer to the base manual for a comprehensive listing of all parts. When ordering replacement parts from the Watkins-Johnson Company, specify the unit type, the serial number, and the option configuration. Also include the reference designation and the description of each item ordered. The list of manufacturers, provided in **paragraph G.5.2**, and the manufacturer's part number, provided in **paragraph G.5.4**, are supplied as a guide to aid the user of the equipment while in the field. The parts listed may not necessarily be identical with the parts installed in the unit. The parts listed in **paragraph G.5.4** will provide for satisfactory unit operation.

Replacement parts may be obtained from any manufacturer provided that the physical characteristics and electrical parameters of the replacement item are compatible with the original part. In the case where components are defined by a military or industrial specification, a vendor is suggested as a convenience to the user.

**NOTE**

As improvements in semiconductors are made, it is the policy of Watkins-Johnson to incorporate them in proprietary products. As a result, some transistors, diodes and integrated circuits which are installed in the unit may not agree with the parts lists or schematic diagrams of this manual. However, the semiconductor devices listed in this manual may be substituted with satisfactory results.



WJ-871Y/PCSM2 PERSONAL COMPUTER SIGNAL MONITOR OPTION

APPENDIX G

G.5.4 WJ-871Y/PCSM2 PERSONAL COMPUTER SIGNAL MONITOR OPTION

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
	Revision A				
A1*	PCSM2 Option PC Assembly	1	797201-3	14632	
A2A1**	PCSM2 Option PC Assembly	1	797201-3	14632	
J1	Connector, Plug: 9-position, D-style	1	205204-1	00779	
P1	Connector, Receptacle	1	M80-8881005	14632	
W1	Cable Assembly	1	283254-1	14632	
	Accessory Items				
	I/O Communications Board	1	POR-0002-XX-2321	0FJN4	
	Software, Graphical User Interface	1	841949	14632	
	Null Modem Adapter, 9-pin to 25-pin	1	117	86072	
	Null Modem Cable Assembly, 9-pin to 25-pin	2	119-6	86072	
	Spacer, .187 x .400, 4-40 Stud	5	283051-1	14632	
	Washer, Flat, No. 4	10	MS15795-803	96906	
	Washer, Lock, No. 4	10	MS35338-135	96906	
	Screw, Pan Head, 4-40 x 5/16	5	MS51957-14	96906	
	Screw/Lock Kit	2	205817-1	00779	
	Label, PCSM2	1	283479-1	14632	
	* Designated A1 for WJ-8712A Series receivers.				
	** Designated A2A1 for WJ-8711A and HF-1000 Series receivers				