BAE SYSTEMS

INSTRUCTION MANUAL

FOR THE

WJ 9040 IFD220 IF DEMODULATOR

INSTRUCTION MANUAL

FOR THE

WJ 9040 IFD220 IF DEMODULATOR

WATKINS-JOHNSON COMPANY
700 Quince Orchard Road
Gaithersburg, MD 20878

November 1987

WARNING

This equipment employs dangerous voltages which may be fatal if contacted. Exercise extreme caution in working with this equipment with any of the protective covers removed.

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

Toll Call: (301) 948-7550 Ext. 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.

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 procedure:

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. 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%

TABLE OF CONTENTS

SECTION I

GENERAL DESCRIPTION

SECTION II

INSTALLATION AND OPERATION

TABLE OF CONTENTS - (Continued)

SECTION III

CIRCUIT DESCRIPTION

TABLE OF CONTENTS - (Continued)

SECTION III - (Cont'd)

CIRCUIT DESCRIPTION

SECTION IV

MAINTENANCE

TABLE OF CONTENTS - (Continued)

SECTION III - (Cont'd)

MAINTENANCE

SECTION V

REPLACEMENT PARTS LIST

TABLE OF CONTENTS - (Continued)

LIST OF ILLUSTRATIONS

LIST OF TABLES

TABLE OF CONTENTS - (Continued)

LIST OF TABLES - (Cont'd)

SECTION I

GENERAL DESCRIPTION

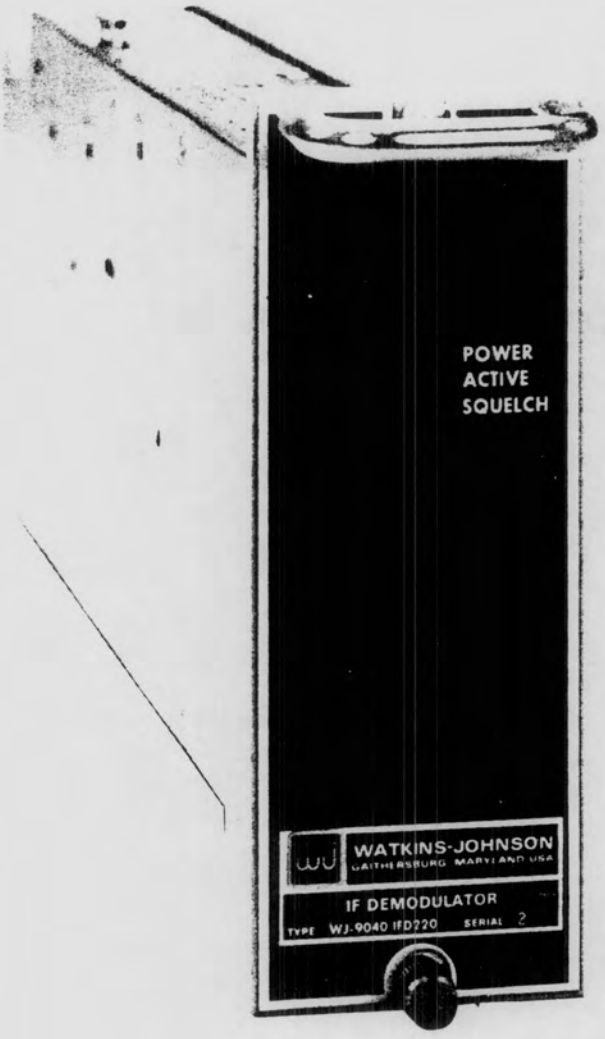


Figure 1-1. WJ 9040 IFD220 IF Demodulator

SECTION I

GENERAL DESCRIPTION

1.1 ELECTRICAL CHARACTERISTICS

The WJ 9040 IFD220 IF Demodulator (Figure 1-0) provides Intermediate Frequency signal demodulation capabilities for any receiver or RF Tuner which has a 21.4 MHz low level IF or SM output. The unit operates as an independent IF Demodulator with up to four selectable bandwidths in the 5 kHz to 8 MHz range. This then increases the overall receiver bandwidth capability by four additional bandwidths. The unit can demodulate AM, FM, Pulse, SSB and CW signals. An external BFO input from the WJ-8628-4 Receiver, or other source of 21.4 MHz, 0 dBm, is required when the SSB and CW Detection Modes are used. The WJ 9040 IFD220 IF Demodulator is designed to function as a component of the Watkins-Johnson Company WJ 9040 System. However, the WJ 9040 IFD220 IF Demodulator may be used in other systems provided the necessary power supply and interfaces are provided to support independent configuration in a another type system.

The WJ 9040 IFD220 is controlled through the WJ 9040 IOM108 I/O Interface Module by the WJ-8628-4 Receiver, or remotely through IEEE-488 or RS-232 Options in the IOM108.

1.2 MECHANICAL CHARACTERISTICS

The IFD220 is normally mounted in a 19-inch wide WJ 9040 System Equipment Frame (EFR100) and occupies one-eighth the width of the frame. The main deck and chassis, front, side, rear and top panels are constructed of aluminum. All operating indicators are on the front panel, while all input and output lines are routed through the rear panel. The front panel is a 0.19 inch thick aluminum plate overlaid with a 0.032 inch black bezel etched with control markings.

The rear panel mounts all input and output connectors. A 25-pin D series connector interfaces the DC supply voltages and any required control I/O and Polled I/O signals between the IFD220 and the EFR100 Equipment Frame backplane. Three SMA connectors provide signal interconnection between the IFD220 and other system equipment. A nine-pin SRE connector interfaces the required auxiliary signals.

The unit consists of a main chassis and two major assemblies:

a. 21.4 MHz IF Demodulator, Type 794582-2 (A1) consisting of:

1. 21.4 MHz Bandpass Amplifier, Type 371150-2 (A1A1),

2. AM/SSB/CW Demodulator, Type 371575-1 (A1A2),

3. Video/Audio/COS, Type 371571-1 (A1A3),

1.2 **MECHANICAL CHARACTERISTICS - (Continued)**

4. Digital Interface, Type 371665-1, (A1A4),

5. FM Demodulator Motherboard, Type 371249-1, (A1A5),

The FM Demodulator Motherboard (A1A5) mounts A1A5A1 through A1A5A4, which are customer selectable IF Bandwidth Options. (See the **WJ-9928-XXX Instruction Manual** for additional information.)

b. Front Panel with LED Flexible Board, Type 271134-3 (A2).

The IFD220 is designed for easy disassembly. The front and rear panels are held on by screws and can be easily removed. All operator indicators (POWER, ACTIVE, SQUELCH) are located on the front panel. All interconnections to the IFD220 are made through the rear panel.

1.3 **EQUIPMENT SUPPLIED**

No additional equipment is supplied with the WJ 9040 IFD220 IF Demodulator.

1.4 **EQUIPMENT REQUIRED BUT NOT SUPPLIED**

The IFD220 requires external equipment for proper operation. The minimum equipment required for operation is as follows:

a. WJ-8628-4 VHF/UHF Master Acquisition Receiver, or equivalent, or other controller such as the WJ 9040 IOM108 I/O Interface Module.

b. WJ-9040 EFR100 Equipment Frame with:

1. EPS100 Power Supply,

2. IOM108 Interface Module.

1.4.1 **WJ-8628-4 RECEIVER**

The WJ-8628-4, or other equivalent Receiver, is the controlling unit for the system. The unit can also be controlled through the WJ-9040 IOM108 I/O Interface Module, in which case the Receiver is not needed.

1.4.2 WJ 9040 EFR100 EQUIPMENT FRAME

The WJ 9040 EFR100 Equipment Frame is used to physically mount the IFD220 and any other WJ 9040 System Equipment contained in the system. The following paragraphs list the WJ 9040 components, or customer furnished equivalent components, that are a required part of the Equipment Frame for IFD220 operation. Also, refer to the **WJ 9040 Common Equipment Instruction Manual** for more detailed information concerning WJ 9040 Common Equipment Components.

1.4.2.1 EPS100 POWER SUPPLY

The EPS100 Power Supply provides +8.2 VDC, +18 VDC, -18 VDC, and +29 VDC to the IFD220 and other system modules.

1.4.2.2 IOM108 I/O INTERFACE MODULE

The IOM108 I/O Interface Module is used to interface the IFD220 with other system modules. It is a Digital I/O Module that routes audio and control signals to and from receivers and demodulators. In addition, an IEEE-488 or RS-232 Interface can be plugged into the unit to allow for system remote control.

1.5 OPERATIONAL OVERVIEW

The IFD220 IF Demodulator is normally part of the WJ 9040 System and will typically be operated in a WJ 9040 System environment. The demodulator is designed to plug into the WJ 9040 EFR100 Equipment Frame. The Demodulator receives all DC power, control instructions, and commands via a 25-pin D-Type connector that mates with a counterpart on the EFR100 Equipment Frame, or other customer furnished equivalent frame. The Receiver interfaces with the Demodulator through the IOM108 I/O Interface Module that mounts on the rear of the EFR100 Equipment Frame. **Figure 1-2** is a simplified block diagram showing the relationship between the major elements of the WJ 9040 System.

1.6 TABLE OF SPECIFICATIONS

Table 1-1. WJ 9040 IFD220 IF Demodulator Specifications

Input Frequency	21.4 MHz
IF Bandwidth	Any Four, From 2.85 kHz to 8 MHz

IF BW	IF Shape Factor 60/3 dB Typical
2.85 kHz	2.5:1
10 kHz	2.5:1
20 kHz	2.5:1
50 kHz	2.5:1
100 kHz	2.5:1
200 kHz	2.5:1
500 kHz	4.0:1
1 MHz	3.8:1
2 MHz	3.0:1
4 MHz	3.0:1
8 MHz	3.0:1

(For other bandwidths contact factory.)

Noise Figure	17 dB Typical
Detection Modes	AM, FM, SSB, CW, Pulse (CW and SSB require WJ-8628-4 BFO Output or external 21.4 MHz, 0 dBm signal)
AGC Range	70 dB
Manual Gain Control	70 dB
RF AGC Output	0 V to +5 VDC
AM Stability with AGC	6 dB change from AGC Threshold to 70 dB above AGC Threshold (maximum input of -10 dBm)
Squelch Range	Noise Level to approximately 50 dB above noise
IF Output	21.4 MHz, -20 dBm, 50 ohms nominal at AGC Threshold input levels

Table 1-1. WJ 9040 IFD220 IF Demodulator Specifications - (Continued)

Video Output	0.35 VRMS into 75 ohms with input level at AGC Threshold, 50% AM or 30% x IF BW peak deviation for FM
Video Response	DC to 1/2 selected IF BW for FM, 200 Hz to 1/2 IF BW for AM
Audio Output	1.25 VRMS into 600 ohms with input level at AGC Threshold, 50% AM or 30% x IF BW peak deviation for FM. 200 Hz - 10 kHz
Power	8 watts
Weight	4.5 lbs.
Size	5.2 inches High, 2.0 inches Wide 14.38 inches Deep (WJ 9040 1/8th Rack)
Connectors:	3 - SMA Connectors 1 - 25-Pin D Connector 1 - 9-Pin SRE Connector for Auxiliary
Operating Temperature Range	0 to +50 degrees C

FIGURE 1-2 WJ 9040 IFD220 IF DEMODULATOR

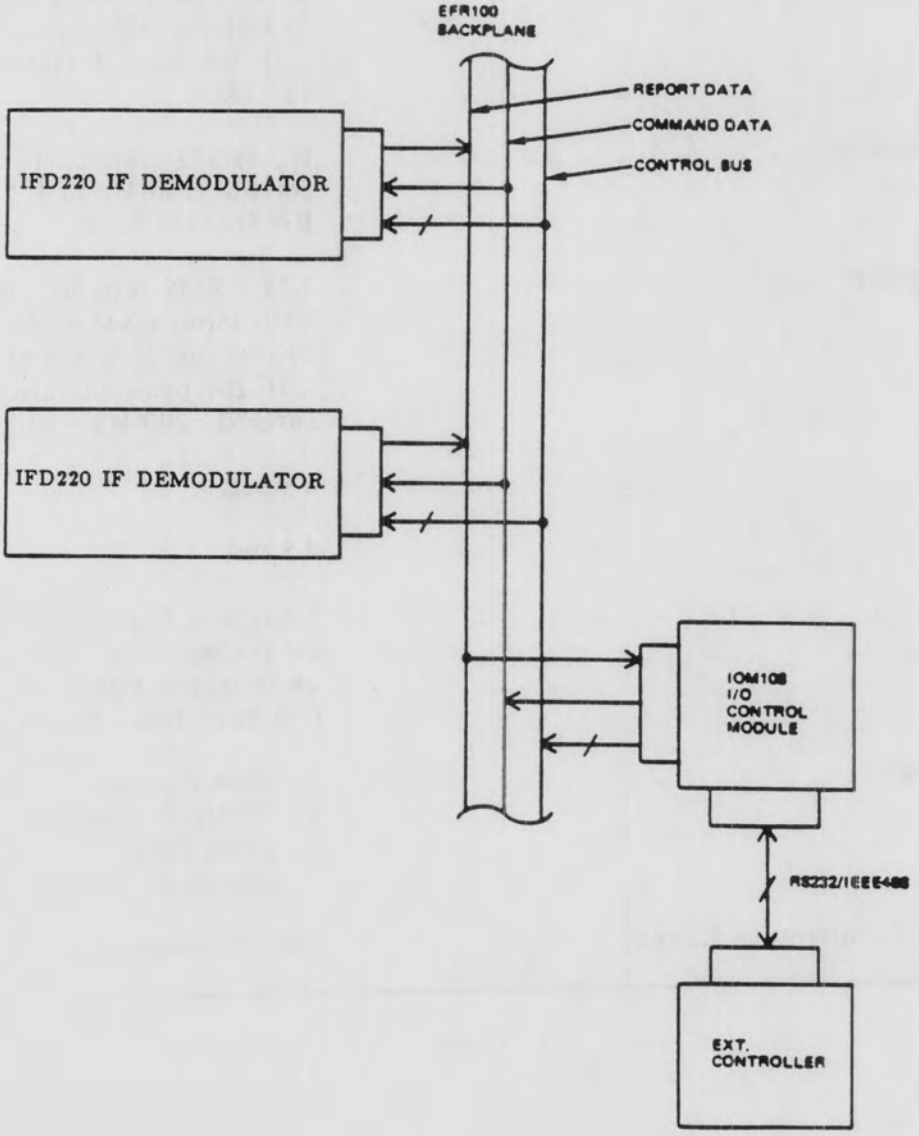


Figure 1-2. WJ 9040 System Configuration Block Diagram

SECTION II

INSTALLATION AND OPERATION

2.1 UNPACKING AND INSPECTION

Examine the shipping carton for damage prior to unpacking the equipment. If the carton appears to be damaged, have the carrier's agent present when the equipment is unpacked. If this is not possible, retain all packaging material and shipping containers for the carrier's inspection to verify damage to the equipment after unpacking. Also verify that the equipment shipped corresponds to the packing slip. Contact the Watkins-Johnson Company, CEI Division, or your Watkins-Johnson representative for any discrepancies or shortages.

The unit was thoroughly inspected and factory adjusted for optimum performance prior to shipment. It is, therefore, ready for use upon receipt. After uncrating and checking contents against the packing slip, visually inspect all exterior surfaces for dents and scratches. If external damage is visible, remove the dust covers and inspect the internal components for apparent damage. Then check the internal and external cables for loose connections, and plug-in items which may have been loosened from their receptacles.

2.2 REPACKING

If the equipment must be prepared for reshipment, the packing methods should follow the pattern established in the original shipment. If retained, the original materials can be reused to a large extent or at least provide guidance for the repackaging effort. Conditions during storage and shipment should be limited as follows:

Maximum humidity:	95% (no condensation)
Temperature range:	-40 degrees C to +70 degrees C

2.3 INSTALLATION PROCEDURES

The IFD220 is designed to be mounted in the EFR100 Equipment Frame. Specific installation procedures for the EFR100 Equipment Frame Installation are covered in the **WJ 9040 System Common Equipment Instruction Manual.** However, the following general guidelines should be observed when using the IFD220 in the WJ 9040 operational environment:

a. Operating temperature range should be from 0 degree C to +50 degree C.

2.3 **INSTALLATION PROCEDURES - (Continued)**

b. Free air circulation should be allowed between equipment frames. Multiple stacking significantly increases ambient temperatures.

c. Use only stable, properly grounded AC power for the WJ 9040 equipment.

d. Secure the IFD220 in the frame by rotating the four front panel locking screws clockwise until tight.

2.3.1 **TYPICAL IFD220 INSTALLATION**

The following paragraphs describe a typical IFD220 installation.

In a typical system the IFD220 is normally co-located in the same ERF100 Equipment Frame as the WJ-8628-4 Receiver, but is not necessarily a requirement. The following IFD220 rear panel connections are required:

a. Receiver prefiltered SM or IF Output connects to J4,

b. 9 Pin SRE Auxiliary Connector from the Receiver connects to J5,

Note: The WJ 9040 Backplane Connector, J1 (25 pin D Connection) is completed when the IFD220 is installed in the EFR100 Equipment Frame.

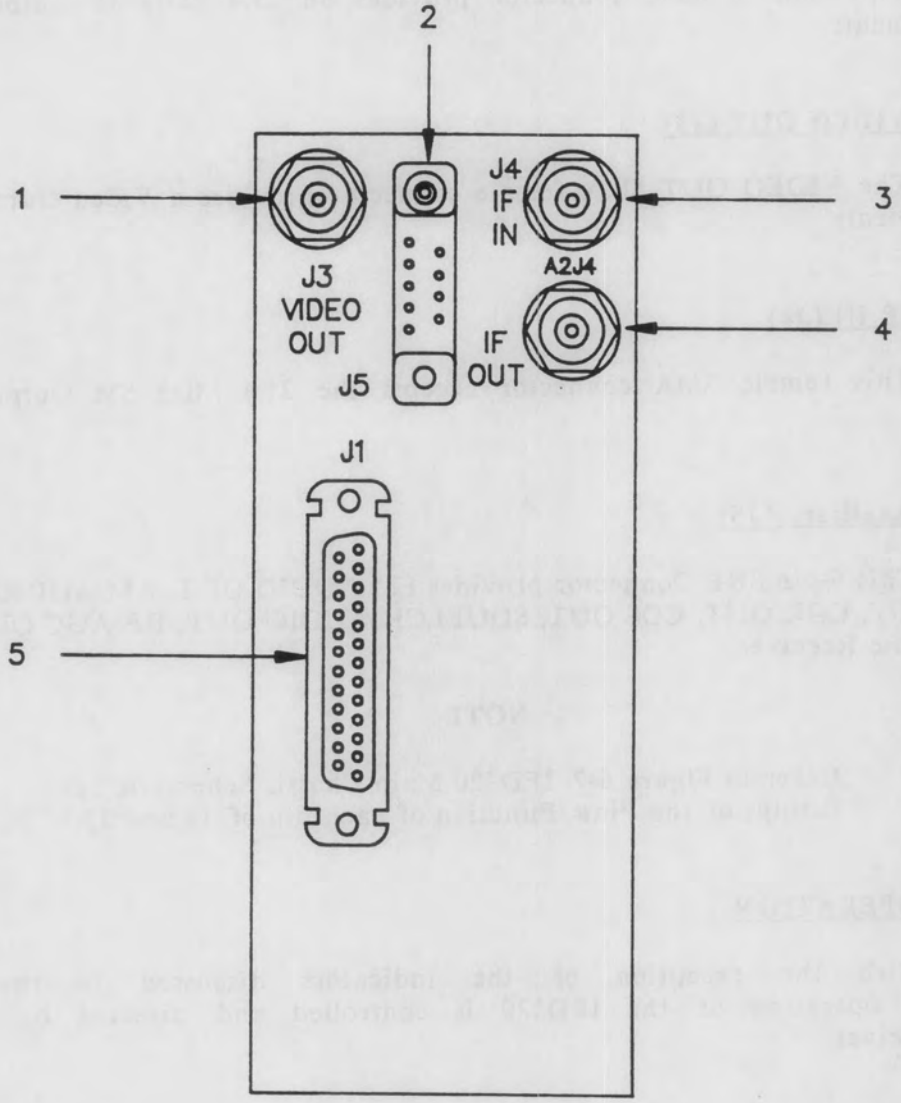
c. An IF Output (A2J4) and a Video Output (J3) is available for use as required.

2.3.2 **INPUT/OUTPUT CONNECTORS**

The Input/Output connectors of the IFD220 are shown in **Figure 2-1.** All connections to the IFD220 are made through the connectors on the rear panel. A 25-pin D type connector (J4) mates with a counterpart in the EFR100 Equipment Frame to provide DC power and a communication path to the IOM108 I/O Control Module. Three SMA female connectors provide signal input and output connections and a 9-pin SRE type connector provides outputs for the receiver. These connectors are described in the following paragraphs.

2.3.2.1 **WJ 9040 Backplane Connector (J1)**

The WJ 900 Backplane connector mates with a connector on the EFR100 Equipment Frame when the IFD220 is installed. This connection supplies DC Voltage and a communication path to the IOM108 I/O Interface Module.



1. Video Out (J3)
2. Auxiliary (J5)
3. IF Input (J4)
4. IF Output (A2J4)
5. EFR100 Backplane (J1)

Figure 2-1. WJ 9040 IFD220 IF Demodulator Rear Panel Connectors

2.3.2.2 **IF OUTPUT (A2J4)**

This SMA female connector provides an 21.4 MHz IF output for other system requirements.

2.3.2.3 **VIDEO OUT (J3)**

The VIDEO OUT SMA female connector provides a Video Output for other system requirements.

2.3.2.4 **IF IN (J4)**

This female SMA connector accepts the 21.4 MHz SM Output from the Receiver.

2.3.2.5 **Auxiliary (J5)**

This 9-pin SRE Connector provides FM AUDIO OUT, AM AUDIO OUT, SIGNAL STRENGTH OUT, COR OUT, COS OUT, SQUELCH AUDIO OUT, RF AGC OUT, and AFC OUT connections to the Receiver.

NOTE

Refer to **Figure 6-7**, IFD220 Main Chassis Schematic for listings of the Pin#/Function of each pin of J4 and J5.

2.4 OPERATION

With the exception of the indicators discussed in the following paragraphs, all operation of the IFD220 is controlled and directed by the Master Acquisition Receiver.

2.4.1 POWER

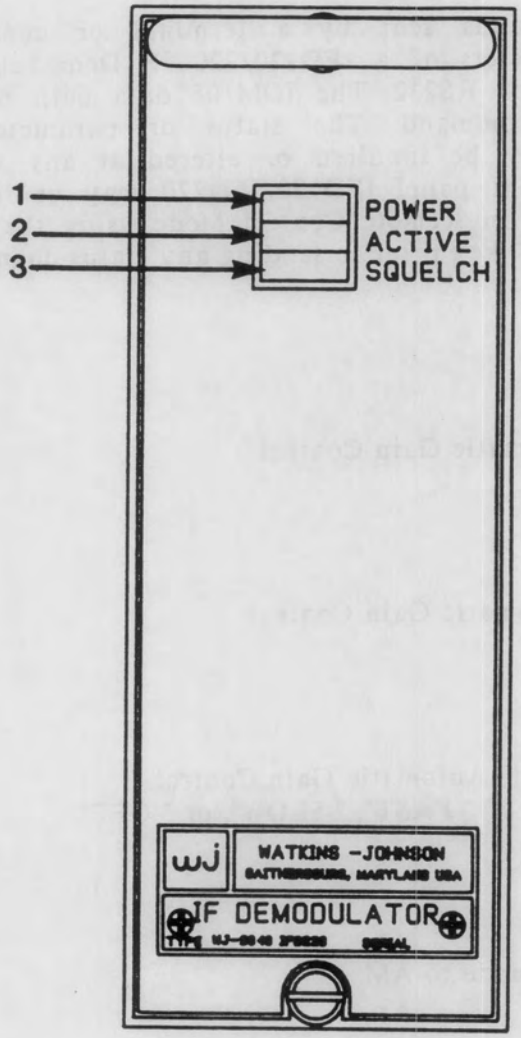
The Red PWR indicator is lit when power is applied to the system.

2.4.2 ACTIVE

The Amber ACTIVE indicator is lit when the IFD220 is active as part of the receiving system.

2.4.3 SQUELCH

The Green SQUELCH indicator is lit when the tuned signal strength exceeds the Squelch level.



1. POWER
2. ACTIVE
3. SQUELCH

Figure 2-2. WJ 9040 IFD220 IF Demodulator Front Panel Indicators

INSTALLATION AND OPERATION

2.5 REMOTE COMMANDS

NOTE

The following commands sent by a terminal or computer will alter or interrogate the parameters of a IFD120/220 IF Demodulator via the IOM108 and either IEEE-488 or RS232. The IOM108 data path must first be selected with the **"SLOTn"** command. The status or parameters of the remotely controlled IFD220 may be inquired or altered at any time. The status or parameters of the front panel IFD120/IFD220 may be inquired at any time, but it must be placed in Remote Control Mode using the "RMT" commands or front panel "RMT/LCL" key prior to sending any status changes.

"AGC"

Turns on the Automatic Gain Control.

"AGC/"

Turns off the Automatic Gain Control.

"AGC?"

Asks for the state of Automatic Gain Control.
Returns a response of " FAST", " SLOW", or " OFF".

"AM"

Sets the detection mode to AM.

"AUDn"

Polled Audio to Slot **n** is enabled.

"AUD?"

Asks which Slot has the Polled Audio enabled. Returns "AUD n" where **n** is the Slot number.

2.5 **REMOTE COMMANDS - (Continued)**

"BW n"

Selects bandwidth number **n**, where **n** is in the range of 1 to 5 if the IFD220 has the Fifth IF Option, and 1 to 4 otherwise. The value **n** represents the position of the hardware in the IF Demodulator. The actual bandwidth is determined by the type of IF card installed. See "BWC?"

ERRORS: If **n** is outside the range, the command is ignored.

"BW?"

Asks for the bandwidth number.
Returns a number 1 through 5 if the IF Demodulator has the Fifth IF Option, or 1 through 4 otherwise. For the actual IF bandwidth in kHz or MHz, see "BWC?"

"BWC?"

Asks for the actual bandwidth. Returns the bandwidth in kHz or MHz.
Examples: " 3 kHz", " 1.4 MHz"

"CLR"

Clears the status of the addressed unit and sets the unit to a default state.

"COR n" or **"COS n"**

Sets the Carrier Operated Squelch (COS) level to **n**. **n** must be in the range of 0 to 63.

ERRORS: If **n** is outside the range 0 to 63, the command is ignored.

"COR?" or **"COS?"**

Asks for the level of Carrier Operated Squelch (COS). Returns the COS level setting.

2.5 REMOTE COMMANDS - (Continued)

"CST?"

Asks for the state of COS.
Returns "ON" if the signal strength is greater than the COS setting.
Returns "OFF" otherwise.

"CW"

Sets the detection mode to CW.

"DET?"

Asks for the detection mode. Returns the selected detection mode.

"EXAMn"

Asks for a description of the unit in Slot **n**. Returns the IF Demodulator type and identifies certain options.
Examples: " IFD220 /HPI"

"FM"

Sets the detection mode to FM.

"LCL"

Sets the IFD to Local front panel control (IFD120 only).

"LSB"

Sets the detection mode to LSB, if the SSB IF filter is installed in Bandwidth slot #1.

"PLS"

Sets the detection mode to PLS.

2.5 **REMOTE COMMANDS - (Continued)**

"RFG n"

Sets the RF Gain level to **n**, range 0 to 63 where 0 is maximum gain, 63 is minimum. The data is placed in memory regardless of the IF Demodulator's gain mode, but the mode must be manual ("AGC/") for the RFG level to be used.

Errors: The command is ignored if **n** is out of range.

"RFG?"

Asks for the RF Gain level. Returns the RF Gain level from 0 to 63. Data is returned regardless of receiver gain mode.

"RMT"

Sets the IFD into Remote control (IFD120 only).

"RMT?"

Asks the remote status. Returns:
" REMOTE" if the unit is in Remote control
" LOCAL" if the unit is in Local control

The IFD220 is always in Remote Mode.

"SLOTn"

Addresses Slot **n**, where **n** is 1 to 8, so that the following commands will be sent to that Slot.

Errors: If **n** is out of range, the command will be ignored.

"SLOT?"

Asks for the addressed Slot. Returns the Slot number of the unit currently being controlled in the format " Slot n".

"SS?"

Asks for the relative signal strength of the tuned signal. Returns a value from 0 to 99, 0 is minimum and 99 is maximum.

2.5 REMOTE COMMANDS - (Continued)

"USB"

Sets the detection mode to USB, if the SSB IF filter is installed in the Bandwidth Slot #1.

The IFD-120/220 may be used as a stand-alone demodulator with a 21.4 MHz IF signal supplied by any external device. An RF-AGC output compatable with the WJ-8628 Series Receivers is provided. This would be connected to a modified WJ-8628 when the IFD is used as a bandwidth extender. The WJ-8628 must be wired to accept the external AGC signal and select it when a bandwidth in the IFD is used.

The above remote commands can be used for any configuration of the IFD120/220 in a 9040 - EFR100 Equipment frame. When the IFD is connected to a modified WJ-8628 Receiver, the following sequence of commands must be sent for the correct signal paths to be selected.

1. Determine which IF Bandwidth Filter is to be selected.

2. If the desired BW is in the 8628 receiver, follow steps in **A)**. If the BW is in the IFD Module then follow steps in **B)**.

A) To select a BW in the Receiver :

Send these commands to the IFD :
SLOTn -- Select the IOM108 data path to the IFD.
AGC/ -- Turn off AGC (selects MGC).
RFG 63 -- Sets Manual Gain to minimum.

Send these commands to the Receiver :
SLOTn -- Select the IOM108 data path to the Receiver.
XAGC/ -- Turn off external AGC control line.
BWn -- Select the Bandwidth.
Set Gain mode and RFG level as required.

B) To select a BW in the IFD :

Send these commands to the Receiver :
SLOTn -- Select the IOM108 data path to the Receiver.
AGC/ -- Turn off AGC (selects MGC).
RFG 63 -- Sets Manual Gain to minimum.
XAGC -- Turn on external AGC control line
Note: If CW Detection Mode is desired in the IFD, the Receiver must be set to CW to provide a BFO signal to the IFD.

Send these commands to the IFD :
SLOTn -- Select the IOM data path to the IFD.
BWn -- Select the Bandwidth.
Set Gain mode and RFG level as required.

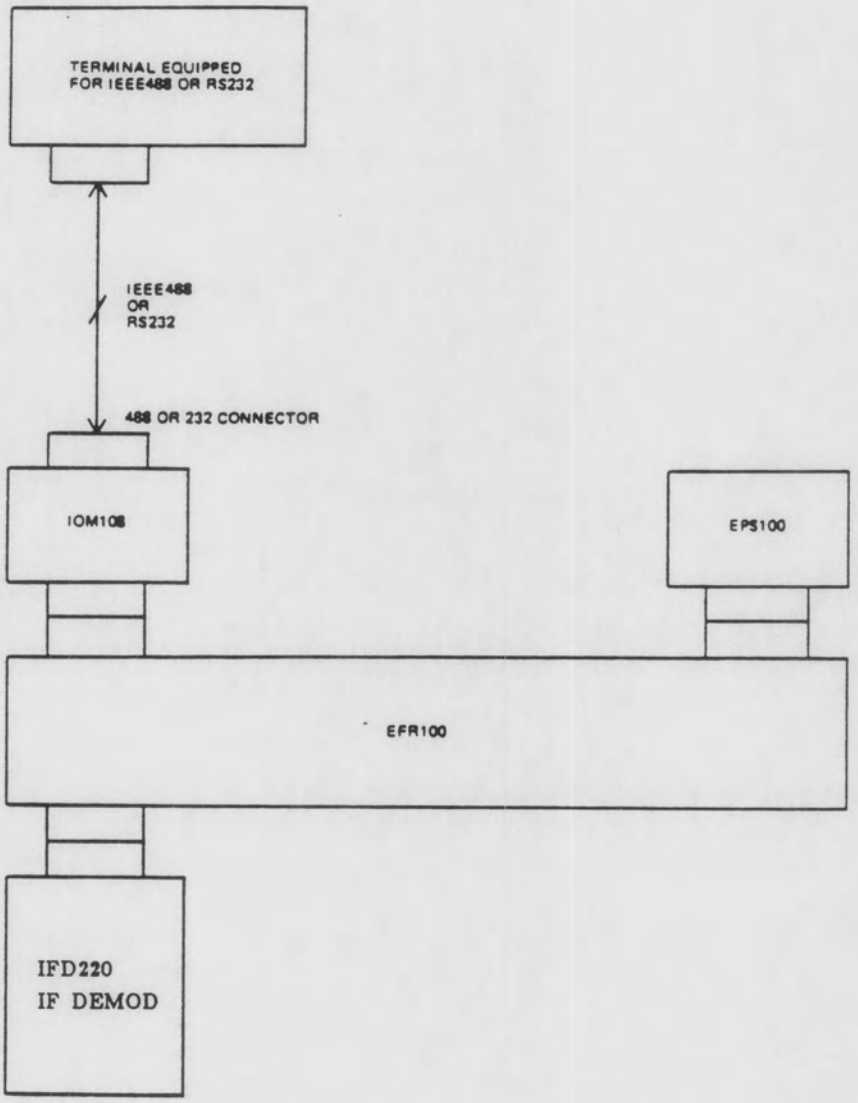


Figure 2-3. Remote Control Hardware Configuration

SECTION III

CIRCUIT DESCRIPTION

3.1 INTRODUCTION

This section describes the general theory of operation of the WJ 9040 IFD220 IF Demodulator.

3.2 GENERAL DESCRIPTION

As shown in **Figure 6-7**, the WJ 9040 IFD220 IF Demodulator Main Chassis Schematic, the WJ 9040 IFD220 consists of the following major modules:

a. 21.4 MHz IF Demodulator, Type 794582-2 (A1) consisting of:

1. 21.4 MHz Bandpass Amplifier, Type 371150-2 (A1A1),
2. AM/SSB/CW Demodulator, Type 371575-1 (A1A2),
3. Video/Audio/COS, Type 371571-1 (A1A3),
4. Digital Interface, Type 371665-1, (A1A4),
5. FM Demodulator Motherboard, Type 371249-1, (A1A5),

The FM Demodulator Motherboard (A1A5) mounts A1A5A1 through A1A5A4, which are customer selectable IF Bandwidth Options. (For additional information see the **WJ-9928-XXX Instruction Manual.**)

b. LED Flexible Board, Type 271134-3 (A2).

3.2.1 21.4 MHz IF DEMODULATOR (A1)

The 21.4 MHz IF Demodulator (A1) performs the following functions:

a. Band Limiting - The 21.4 MHz IF signal is routed through one of four selectable bandpass filters. Available bandwidths are from 2.85 kHz to 8 MHz.

b. Signal Amplification - A combination of broadband and tuned high gain IF amplifier stages establish the overall gain of the Demodulator and Receiver.

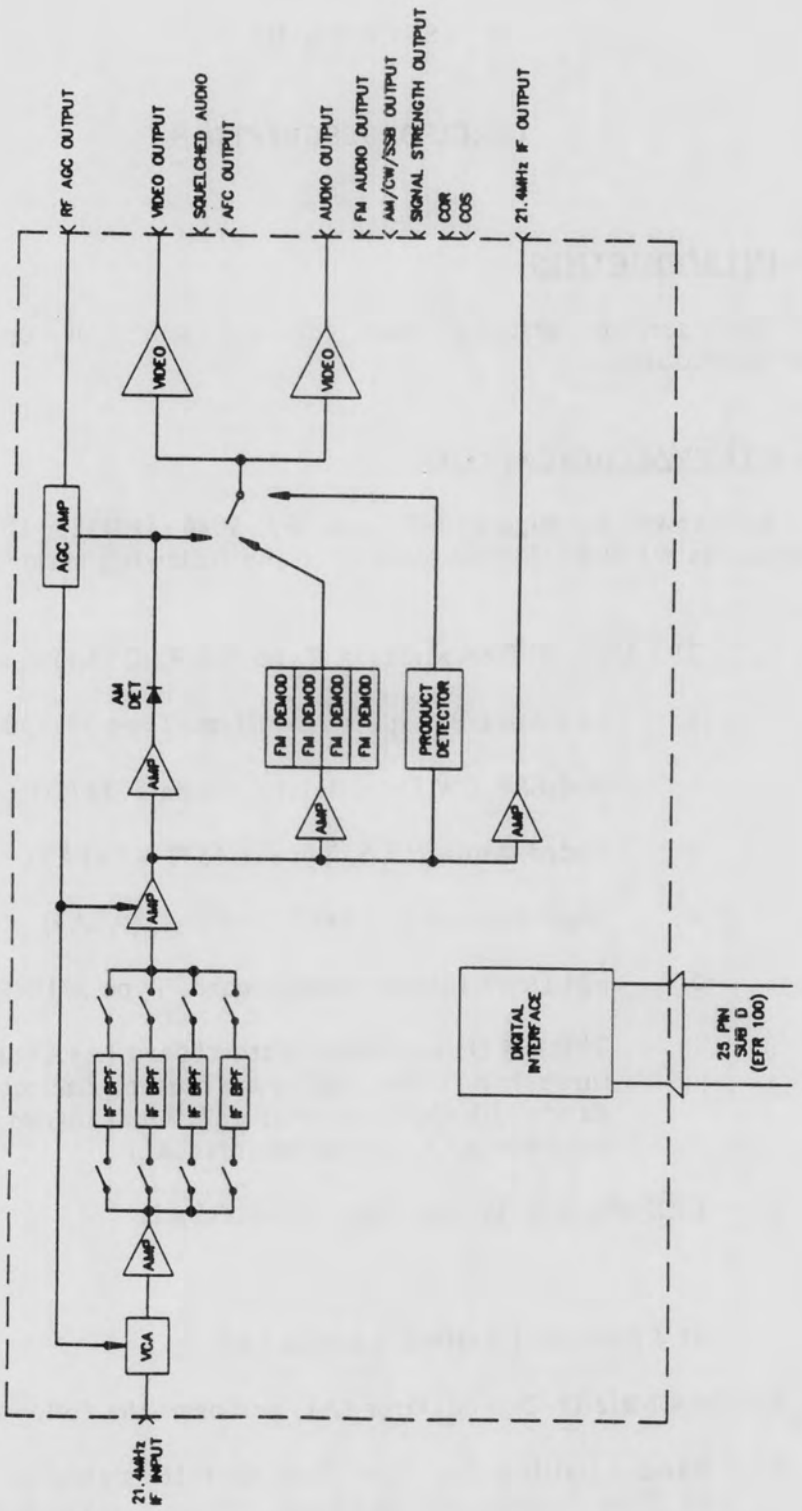


Figure 3-1. 21.4 MHz IF Demodulator (A1) Block Diagram

3.2.1 **21.4 MHz IF DEMODULATOR (A1) - (Continued)**

c. Gain Control - A series of AGC amplifiers adjust the overall gain under conditions of vaying input signal levels in the AGC mode.

d. Signal Demodulation - Three signal demodulators provide demodulated AM, FM, CW, Pulse,, and SSB video outputs.

The 21.4 MHz IF Demodulator's Input/Output connections interface with the following signals.

a. IF Input - The Receiver sends the 21.4 MHz IF input signal to the IFD220.

b. BFO - A 21.4 MHz BFO signal must be provided to the IF Demodulator to operate the CW/SSB Detector.

c. IF Out - A high level 21.4 MHz IF output is provided as a rear panel IFD220 output. This output is 50 ohms, bandlimited by the IF Filter, and is nominally -20 dBm with a RF input signal equal to AGC Threshold.

d. Video Out - A demodulated AM, FM, or CW/SSB signal is provided as a rear panel IFD220 output. This output is 75 ohms and is nominally 0.35 VRMS with an input signal level equal to the AGC Threshold.

e. COM/CONTROL Data - Serial data, clock, strobe and enable lines are sent from the EFR100 Backplane. These lines control the operating parameters.

f. Status - The COS status, signal strength, AFC voltage, service request and polled audio signals are sent to the EFR100 Backplane for monitoring.

g. Audio - Low level audio is sent to the EFR100 Backplane.

As shown above the 21.4 MHz IF Demodulator consists of five major assemblies. A general discussion of each assembly is provided in the following paragraphs. Refer to **Figure 3-1** for an overall diagram of the 21.4 MHz IF Demodulator (A1).

3.2.1.1 21.4 MHz BANDPASS AMPLIFIER (A1A1)

The 21.4 MHz IF signal from the Receiver is sent to the input of the 21.4 MHz Bandpass Amplifier (A1A1). The signal is bandlimited by one of four IF Bandpass Filters selected by the BW SEL line from the AM/SSB/CW Demodulator (A1A2). The AGC voltage from A1A2 adjust the overall gain of the 21.4 MHz Bandpass Amplifier (A1A1). The fixed gain set voltage from the FM Demodulator Motherboard (A1A5) adjusts the gain according to the bandwidth selected to provide a constant Receiver gain-bandwidth product. The amplified bandlimited IF output drives the input to the AM/SSB/CW Demodulator (A1A2).

3.2.1.2 AM/SSB/CW DEMODULATOR (A1A2)

The amplified bandlimited If output from the 21.4 MHz Bandpass Amplifier (A2A1) drives the input of the AM/CW/SSB Demodulator (A1A2). Mode, BW, and AGC/MAN Select signals from the Digital Interface set the operating parameters of the Demodulator. In AM and Pulse Modes, the IF signal is demodulated by an AM Detector. The resulting AM video signal is routed through a video low pass filter on A1A5, then backthrough A1A2 to the Video/Audio/COS (A1A3). In CW/SSB Modes, the IF signal is demodulated by a product detector driven by the BFO signal. The resulting video, also call AM video, is routed through a video low pass filter at the daughter board on A1A5, then back through A1A2 to the Video/Audio/COS (A1A3). In the FM Mode, the 21.4 MHz IF signal is sent to A1A5 where it is demodulated by on of four FM Detectors. The resulting FM video is routed through A1A2 to the Video/Audio/COS (A1A3). The A1A2 module requires a NB select line from the Digital Interface (A1A4) and switches in a double-tuned circuit for all BWs $\leq$200 kHz. The A1A2 module provides RF AGC to the Receiver via the RF AGC OUTPUT. The AM/SSB/CW Demodulator (A1A2) sends a BW Select line and an IF AGC line to the 21.4 MHz Bandpass Amplifier (A1A1); and LOG Signal Strength and AGC Signal Strength to the Video/Audio/COS (A1A3).

3.2.1.3 FM DEMODULATOR MOTHERBOARD (A1A5)

The amplified bandlimited If output signal from the AM/SSB/CW Demodulator (A1A2) drives the input of the FM Demodulator. The FM Demodulator consists of four separate FM demodulator modules, each corresponding to 1 of the 4 bandwidths available for the IFD220, and ultimately the Receiver. The BW Select signal from the Digital Interface (A1A4) selects 1 of the 4 demodulator modules according to which bandwidth has been selected by the receiver. The selected FM demodulator module demodulates the IF signal and sends the resulting video signal to A1A2. When the FM Mode is selected, the FM video signal is routed through A1A2 to the Video/Audio/COS (A1A3).

Each FM Demodulator module has a small resistor network which sends a small analog current to the 21.4 MHz Bandpass Amplifier (A1A1). This current, called the gain set current, has a specific value corresponding to the specific receiver bandwidth selected. The gain set current adjusts the gain of A1A1 according to the bandwidth to provide a constant gain-bandwidth product.

3.2.1.4 VIDEO/AUDIO/COS (A1A3)

The Video/Audio/COS (A1A3) consists of an AM Video Amplifier and an FM Video Amplifier. In the AM Mode, the mode select line from the Digital Interface (A1A4) routes the AM video signal from the AM/SSB/CW Demodulator (A1A2) through the AM video amplifier to the video output terminal. In the FM Mode, the mode select line from the Digital Interface routes the FM video signal from the AM/SSB/CW Detector (A1A2) through the FM Video Amplifier to the video output terminal. AM and FM audio signals are separately and independently available in either the AM or FM Modes.

The Video/Audio/COS (A1A3) also contains a signal strength summing circuit. LOG SS and AGC SS signals from A1A2 are summed to produce the signal strength voltage.

3.2.1.5 DIGITAL INTERFACE (A1A4)

The Digital Interface (A1A4) functions as the major interface point between the EFR100 backplane and the receiver analog circuits.

The EFR100 backplane communicates directly with the Digital Interface (A1A4) via two serial data streams: Receiver Data and Receiver Identification Report. On power up, the Status Report provides the controller section with IF BW codes, and is thereafter not used. Receiver parameter data is transmitted from the EFR100 backplane as a 72-bit serial data stream. This 72-bit word completely defines all receiver operating parameters. **Table 3-2** shows the configuration of this word. As shown, the 72-bit stream is organized into nine-8-bit words. The transfer of the serial data stream into the Digital Interface (A1A4) is coordinated by data transfer timing/control signals. These signals consist of four lines: data, clock, strobe and enable. All 72 bits of the data stream are run into a serial to parallel converter. When all 72 bits have been transferred, the strobe signal latches the data to the converter outputs. This data is presented to the receiver analog section as tuning and select data.

The CMD/CONT DATA IN line is a serial data line. The EFR100 backplane uses this line to transfer receiver parameter data and communication commands to the Digital Interface (A1A4).

The REPORT DATA OUT LINE is used to report a unique serial data word called the configurator. This is a word generated by software that defines the receiver type, tuning range, bandwidth and options present.

The TIMING/CONTROL lines are generated by the external controller and are used to coordinate the transfer of CMD/CONT and REPORT DATA between the Receiver/EF Interface and the External Controller.

Table 3-1. 72-Bit Receiver Parameter Data Word

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
BYTE 1: COMMAND	(1	1	1	1)	(0	0	0	0)
BYTE 2: SIGN	(10 HZ BFO OPTION)				(SIGN)	*	*	*)
BYTE 3: OFFSET	(1 kHz BFO DIGIT)				(100 Hz BFO DIGIT)			
BYTE 4: FREQ 1	(1 kHz FREQ DIGIT)				(100 Hz FREQ DIGIT)			
BYTE 5: FREQ 2	(100 kHz FREQ DIGIT)				(10 kHz FREQ DIGIT)			
BYTE 6: FREQ 3	(10 MHz FREQ DIGIT)				(1 MHz FREQ DIGIT)			
BYTE 7: FREQ 4	(100 MHz FREQ DIGIT)				(100 MHz FREQ DIGIT)			
BYTE 8: COS	(AFC) (DUMP)	(COS THRESHOLD LEVEL)						
BYTE 9: GAIN	(AFC)	(MANUAL GAIN CONTROL LEVEL)						
BYTE 10: BW/DET	(IF BW CODE)				*	*	(DET MODE CODE)	

*indicates bits not used.

Figure 3-2 shows an example of an EFR100 Backplane digital interface connection.

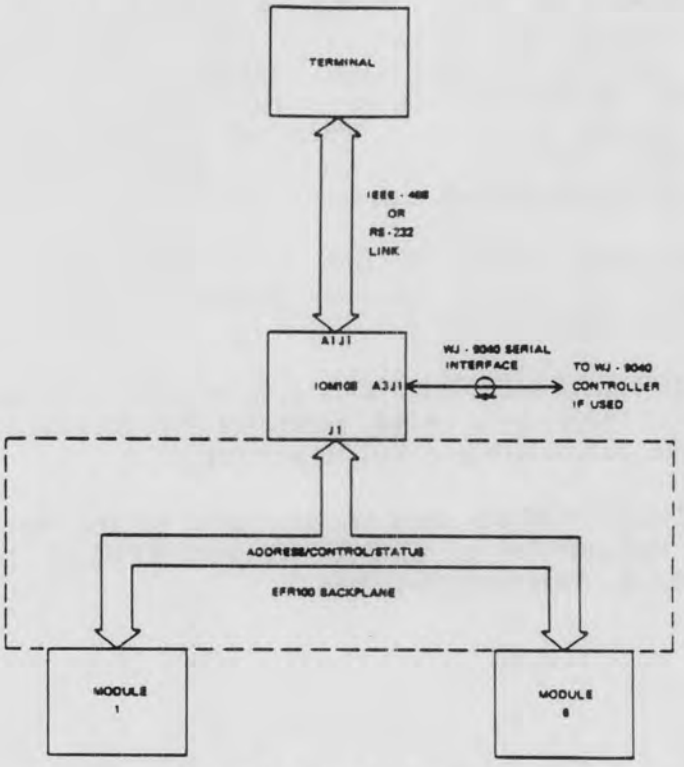


Figure 3-2. EFR100 Backplane Interface

3.2.2 LED FLEXIBLE BOARD (A2)

The LED Fliexible Board (A2) performs the following functions:

a. Power Indication - The POWER Indicator illuminates when power is supplied to the unit.

b. Active Indication - The ACTIVE Indicator illuminates when the Receiver selects a bandwidth that is mounted in the IFD220.

c. Squelch Indication - The SQUELCH Indicator illuminates when a tuned signal exceeds the programmed Squelch level.

All voltages to illuminate the indicators described above are routed from the Digital Interface (A1A4) to the LED Flexible Board (A2).

3.3 DETAILED CIRCUIT DESCRIPTION

The following paragraphs describe the circuit operation of the IFD220 subassemblies.

3.3.1 21.4 MHz IF DEMODULATOR (A1)

In addition to the references listed in the description of each individual subassembly of the 21.4 MHz IF Demodulator (A1) contained in the following paragraphs, also refer to **Figure 6.7**, IFD220 Main Chassis Schematic, for an overall top level reference.

3.3.1.1 21.4 MHz Bandpass Amplifier (A1A1)

Refer to **Figure 3-3**, 21.4 MHz Bandpass Amplifier (A1A1) Block Diagram, and **Figure 6-3**, 21.4 MHz Bandpass Amplifier (A1A1) Schematic Diagram, as aids in understanding the following description. As shown in **Figure 3-3**, the 21.4 MHz Bandpass Amplifier (A1A1) consists of an input amplification section, a bandwidth decoder, four bandpass filters, pin diode switches #1 and #2, and an output amplifier.

3.3.1.1.1 Input Amplification Section

IF signals of 21.4 MHz are applied to pin 3 of U1, a voltage controlled attenuator. The attenuation of U1 is controlled by a DC voltage from A1A1 and is applied to U1, pin 1. The U1 attenuation ranges are from -2 dB for +13 VDC input to -32 dB for +3 VDC input. The output of U1, pin 5, drives the input of Q1, pin 2. Broadband Common Gate JFET Amplifier (Q1) has a gain of +10 dB. The drain of Q1 drives impedance matching network C3, C5, L2, and L3, and then the input to the #1 diode switch.

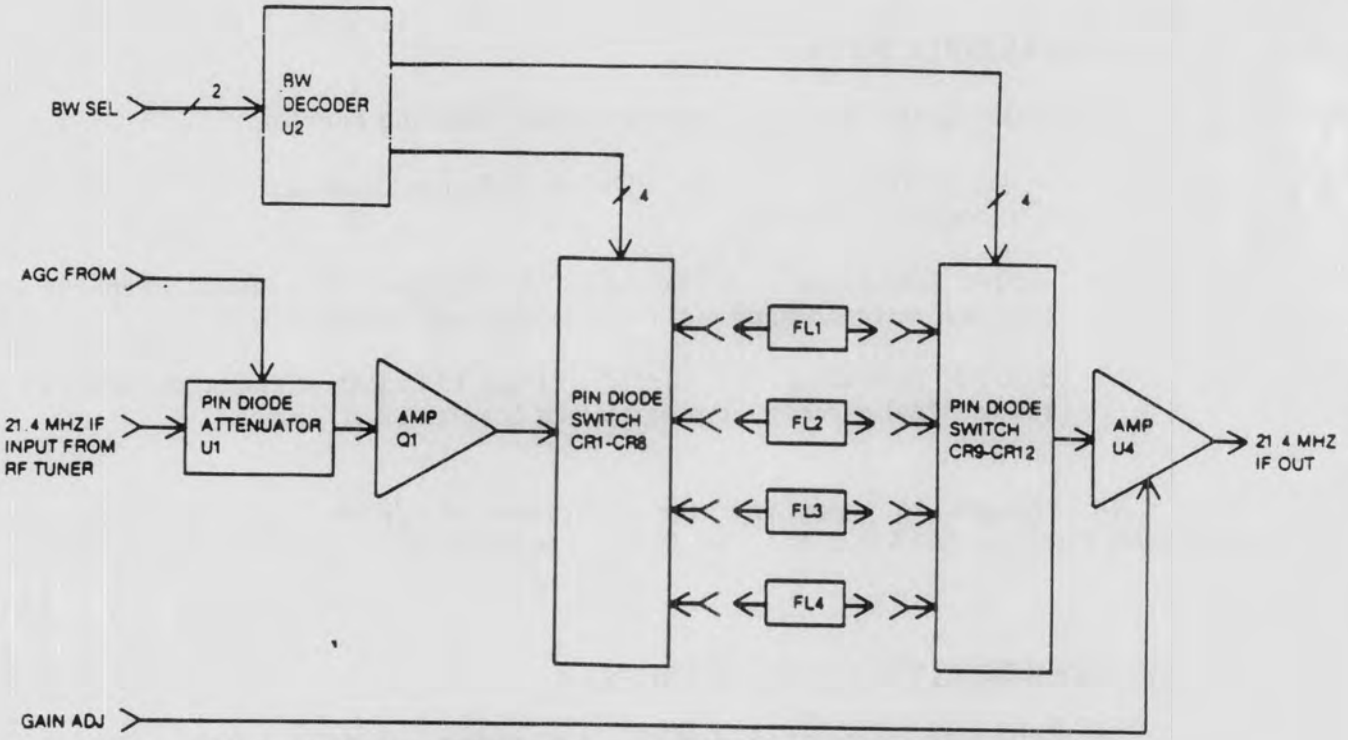


Figure 3-3. 21.4 MHz Bandpass Amplifier (A1A1) Block Diagram

3.3.1.1.2 **Bandwidth Decoder (U2)**

The Bandwidth Decoder (U2), is a 2-bit binary to 4-line decimal decoder. The binary input drives U2 inputs, pins 9 and 10. There are two separate 4-line decimal outputs: output 1 is sent through pins 1, 5, 2, and 4; and output 2 is sent through pins 12, 14, 15, and 11. The logic associated with the decoder is show below.

Inputs		Outputs	
Pin 10	Pin 9	Pins 1,5,2,4	Pins 11,15,14,12
0	0	+15,0,0,0	0,0,0,+15
0	1	0,+15,0,0	0,0,+15,0
1	0	0,0,+15,0	0,+15,0,0
1	1	0,0,0,+15	+15,0,0,0

3.3.1.1.2 **Bandwidth Decoder (U2) - (Continued)**

The decimal switched at pins 1, 5, 2, and 4 provide forward bias to the #2 diode switch consisting of diodes CR9 through CR12. The switched outputs at pins 11, 15, 14, and 12 provide forward bias to diodes CR1, CR3, CR5, and CR7, and reverse biases CR2, CR4, CR6, and CR8.

3.3.1.1.3 **Bandpass Filters (FL1 through FL4)**

The Bandpass Filters (FL1 through FL4) are fixed bandpass filters with a center frequency of 21.4 MHz. The actual bandwidth of each filter is selectable at the customer's option. The range of available bandwidths is from a minimum of 2.85 kHz to a maximum of 8 MHz. The 21.4 MHz IF signal is routed through one of the four bandpass filters by the diode switches. These filters are field-changeable to accommodate different IF bandwidths. Operation of the diodes is explained in **paragraph 3.3.1.1.4.**

3.3.1.1.4 **Diode Switches (#1 and #2)**

Diode Switch #1 consists of diodes CR1 through CR8 and Diode Switch #2 consists of diodes CR9 through CR12. These diodes exhibit low forward resistance when forward biased and extremely high resistance when reverse biased. The diodes are used to route the IF signal through one of four bandpass filters.

The signal path through CR7, FL4, and CR12 is discussed below as an example of the circuit operation.

Assuming the BW select code from A1A2 is equal to 00, the output of U6, pins 1 and 12, equals +15 VDC, and the remaining output pins will be open. Diode Switch #1, diode CR7, is forward biased, CR8 is reverse biased, and diode CR12 is forward biased. These conditions create a low impedance circuit path through CR1, FL1, and CR9 to the input of U9, the output amplifier.

Diodes CR3, CR5, and CR1 are reverse biased by -15 VDC through R17, R21, and R9 and thus have a high resistance, while CR4, CR6, and CR2 are forward biased and have an extremely low resistance. This prevents any of the 21.4 MHz IF signal from T1 from reaching FL2, FL3, or FL4. Overall isolation exceeds 70 dB.

3.3.1.1.5 **Output Amplifier (U4)**

The Output Amplifier (U4) is a broadband, high-gain amplifier. The actual gain of U4 is controlled by a DC current applied to pins 2 and 3. This current is derived from the gain adjust voltage from A1A5. The amplified 21.4 MHz IF signal from U4, Pin 7, is sent to A1A2 which provides proper gain-bandwidth compensation. The maximum gain of U4 is approximately 38 dB.

3.3.1.2 AM/SSB/CW Demodulator (A1A2)

Refer to **Figure 3-4**, the AM/SSB/CW Demodulator (A1A2) Block Diagram and **Figure 6-5**, the AM/SSB/CW Demodulator (A1A2) Schematic Diagram as aids in understanding the following description. As shown in **Figure 3-4**, the AM/SSB/CW Demodulator (A1A2) consists of the following components: an Input IF Amplifier, a Log Signal Strength Detector, a Wideband/Narrowband Filter, an AM Detector, a Product Detector, a Video Switch, a Peak Detector, an AGC Circuit, and a Gain Control Amplifier.

3.3.1.2.1 Input Amplifier (Q1, AT1, U2)

The 21.4 MHz IF signal input from A1A1 is coupled through transformer T2 to match the input impedance of IF amplifier Q1, a high-gain, dual-gate FET amplifier. The gain of Q1 is varied over a 10 dB range by the DC voltage on gate number 2, pin 2. This DC voltage is derived from the AGC control section and is discussed in a later paragraph. The amplified 21.4 MHz IF signal at Q1, pin 1, is coupled through tuned matching network C8, C9, C10, and L4 and drives a broadband amplifier, U2 through AT1.

The Adjustable Attenuator (AT1) is inserted in the signal path between Q1 and U2. It maintains a constant 50 ohms impedance as its attenuation is varied and, is used to adjust the overall gain of the demodulator during IF gain alignment. The amplified 21.4 MHz IF signal output of U2, pin 2, drives the input of the Wideband/Narrowband Filter.

3.3.1.2.2 Logarithmic Signal Strength Detector (U1)

The Logarithmic Signal Strength Detector (U1) is an integrated circuit whose input at pin 15 is driven from the 21.4 MHz IF signal coming from A1A1. The output of U1, pin 13, is a DC voltage whose level varies from 0 to +2 VDC and is proportional to the logarithm of the actual IF signal level. The output of U1, pin 13, is routed to A1A3 as the LOG SS Signal.

3.3.1.2.3 Wideband/Narrowband Filter

The Wideband/Narrowband Filter consists of two circuit paths. One is a broadband low-loss circuit and the other is a narrowband double-tuned IF filter circuit. The actual circuit path is selected by the narrowband select signal from A1A4. The narrowband circuit is selected for all bandwidths less than or equal to 200 kHz. The wideband circuit path consists of diodes CR2 and CR4. The narrowband circuit consists of diodes, CR3, CR5-CR7, and the other double-tuned circuit comprised of C22-C28, and L6 and L7.

3.3.1.2.3 **Wideband/Narrowband Filter - (Continued)**

When the narrowband select signal is low, U3, pin 3, is equal to -15 VDC and U3, pin 4, is open. This forward biases diodes CR2, CR4, CR5, CR7, and reverse biases CR3 and CR6. In turn, a low impedance circuit path is provided from U2, pin 2, through CR2, R17, and CR4, and to the input of Q2. The narrowband path is cut off since diodes CR3 and CR6 are reverse biased and have an extremely high resistance and diodes CR5 and CR7 are shunting the signal path to ground.

When the narrowband select signal from A1A4 is high, the U3, pin 3, output is open and the U3, pin 4, output is equal to -15 VDC. This forward biases CR3 and CR6, and reverse biases CR2, CR4, CR5, and CR7. Then, a low impedance circuit path exists from U2, pin 2, through CR3, the narrowband tuned filter and CR6 to the input of Q2. The wideband circuit path through CR2 and CR4 is cut off as CR2 and CR4 are reverse biased.

3.3.1.2.4 **AM Detector (Q2, CR8, U4)**

The 21.4 MHz IF signal from the wideband/narrowband filter broadband is amplified by Q2, an IF buffer amplifier. The output of Q2's collector is coupled through Broadband Transformer (T1). The signal is demodulated by CR8, the AM detector. The detected AM signals are filtered and amplified by Video Buffer Amplifier (U4) which is operating at unity gain. CR8 is slightly forward biased by -15 VDC through R29. R32 is used to set the DC offset of U4 and therefore compensate for bias voltage on CR8.

3.3.1.2.5 **Product Detector (U6, U7)**

The Product Detector (U6) is a balanced modulator used in the CW/SSB Modes. The 21.4 MHz IF signal from the wideband/narrowband filter is applied to one of the inputs of U6 at pin 4. The BFO signal from the Receiver Synthesizer is applied to the other input of U6 at pin 10. Product Detector (U6) low side mixes the BFO signal with the 21.4 MHz IF signal.

The normal resultant output signal at U6, pin 12, is an audio signal representing the difference between the two input frequencies. The audio signal is then normally applied to pin 3 of U7, an Audio Buffer Amplifier. The video output at U7, pin 1, goes to the Video Switch (U8).

3.3.1.2.6 **Video Switch (U8)**

The Video Switch (U8) has 2 inputs, pins 2 and 5. Pin 5 is the AM video input from the AM Detector whose output is U4, pin 6. U8, pin 2, is the CW/SSB audio input from the Audio Buffer Amplifier (U7), pin 1. The U8 switch is controlled by the CW select signal at A1A4. When the CW select signal is high, U8, pin 5, is connected directly to U8, pin 4. The AM Video Output signal travels from the AM detector through U4, pin 6, to the AM Video Output. When the CW select signal is low, pin 2 is connected to pin 3 and the AM/CW/SSB Video Output travels from the product detector through U7, pin 1, to the AM video output.

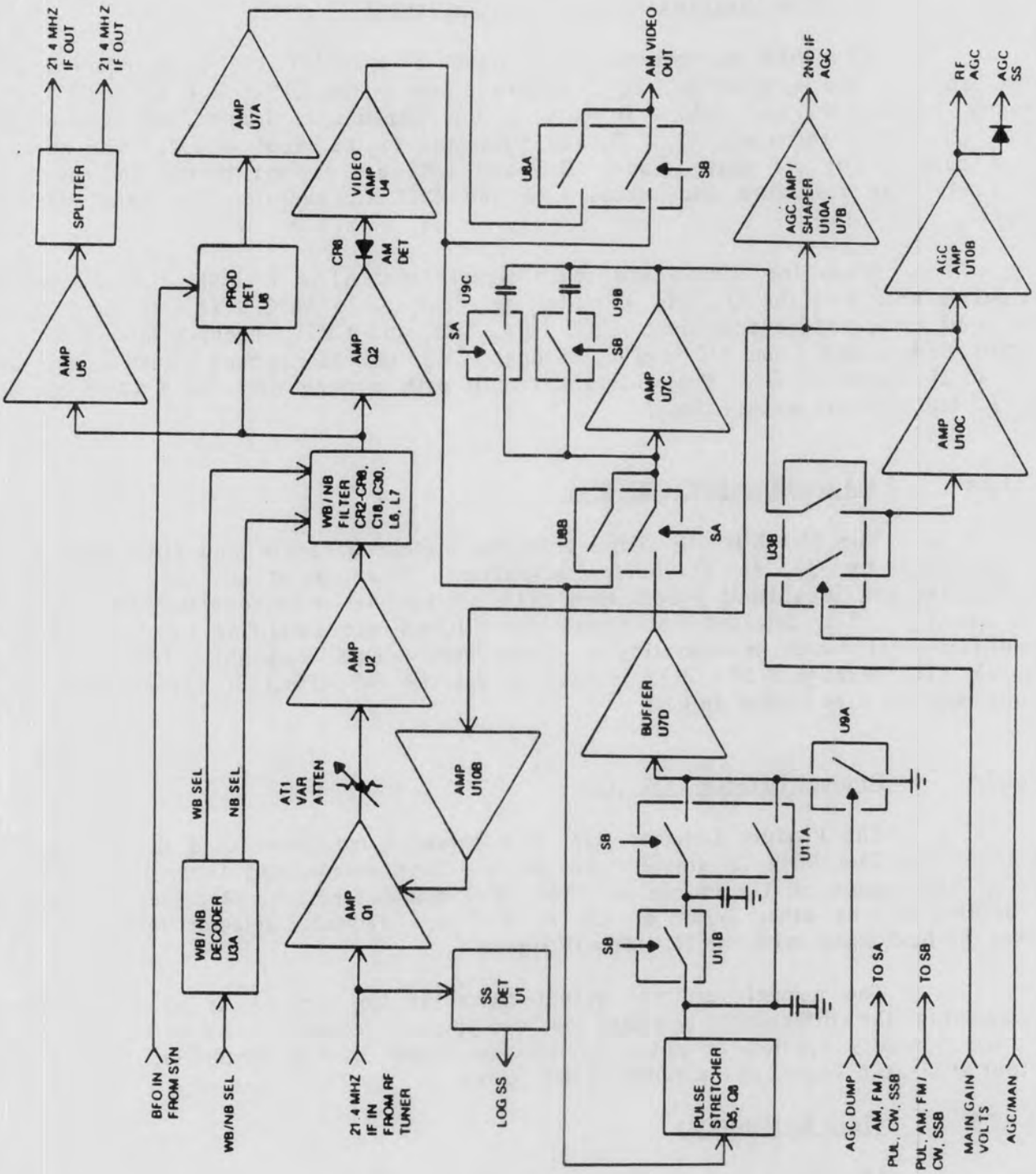


Figure 3-4. AM/SSB/CW Demodulator (A1A2) Block Diagram

3.3.1.2.7 **Peak Detector (Q5, Q6)**

The input for the pulse stretching circuit is taken from the AM Video Amplifier (U4), Q5 and Q6 form a positive peak detector used for Pulse, CW, and SSB Signals. Capacitor C17 is supplied charging current by Q6 and holds the peak when the video signal level drops. The Amplifier (U7) acts as a high impedance input buffer amplifier. The output of U7 is a DC voltage proportional to the peak amplitude of the video signal. Switch U11 adds capacitor C69 and R103 across C17 and R101 in the CW/SSB Modes to increase the time constant of the detector.

The AGC Switch (U8B) is controlled by the AM, FM/PUL, CW, SSB select signal which comes from A1A4. In the AM or FM Mode, this signal is high and U8, pin 10, is connected to U8, pin 11. This arrangement connects the video signal from U4, pin 6, to the inverting input of the Gain Control Amplifier (U7C). In the CW or Pulse Mode, this control line is low and pin 13 is connected to pin 12 of U8. This latter arrangement connects the video signal from U4, pin 6, through the Peak Detector and then to the input of the Gain Control Amplifier, U7C. The use of the Peak Detector is necessary in the CW and Pulse Modes because the signals may have a very low duty cycle (signals are present only briefly and then absent for a long period of time). Consequently, the normal AGC Control Amplifier is not able to adequately process the signals in the SSB/CW or the Pulse mode. The Peak Detector captures the short pulse width signals in the SSB/CW and Pulse Modes and holds the IF gain constant.

3.3.1.2.8 **Gain Control Amplifier (U7, U9, U3, U10)**

The gain control voltage from either U4, pin 6, or the Peak Detector through U7, pin 14, is applied to the input of the Gain Control Amplifier (U7). U7 is a high-gain, DC-coupled low pass filter, and has a biased threshold point. The output at U7, pin 8, starts moving negative (below 0 VDC) if the output from the AGC switch U8 exceeds 0.5 VDC. (At this 0.5 VDC level, the AM Detector Buffer Amplifier (U4) is at 0.5 VDC and the Receiver input level is approximately equal to the rated sensitivity level for the selected IF bandwidth.

The output of U7 travels through the AGC/Manual Select Switch (U3B). This switch is controlled from the MAN SEL line coming from A2A4. If AGC has been selected as a function, the MAN SEL line is low and the output from U7, pin 8, goes through U8, pin 13, to U8, pin 12, and directly to U10C, pin 9. If the Manual Mode has been selected, the MAN SEL line is high and pins 12 and 13 open and disconnect the output from U7. U8 pins 10 and 11 are connected, joining the amplifier (U10C), pin 9, to the manual gain voltage which comes from A1A4. This manual gain voltage replaces the automatic gain voltage from U7, pin 8, and permits the operator to manually adjust the gain of the demodulator. The voltage from A1A4 is approximately 0 to -10 VDC.

The unity gain Buffer Amplifier (U10C) output drives the Gain Control Amplifier (U10A) and the gain controlled If Amplifier (Q1), pin 2, through U10D. The output of U10D is clamped at -5.5 V by Q5. In normal operation, U10C, U710D, and Q5 cause a voltage variation of 0 to -5.5 V across CR1. This yields a 40 dB gain reduction through the IF Amplifier (Q1).

3.3.1.2.9 **AGC Circuit**

The output of U10C draws three separate AGC Amplifiers, U10D, U10A, and U10B which provide three different AGC voltages. U10D provides the first IF AGC to dual gate FET (Q1). The voltage at the output of U10D moves from 0 to approximately -5 VDC where it is clamped by transistor Q4. This provides the first 40 dB of AGC in the receiver. As the output of U10D is being clamped, the RF AGC voltage at pin 7 of U10B is starting to move from 0 VDC to a +5 VDC level for 40 dB of RF AGC before being clamped by Q3. As pin 12 of J2 is clamped at +5 VDC, the output of pin 7 of U7B starts to move from +13 VDC toward approximately 2 VDC for the last 30 dB of AGC in the unit. The voltage is shaped by diode network (CR12 and CR15), and biasing resistors (R64, R65, R61, and R62) which provide 2 changes of slope in the output voltage.

3.3.1.2.10 **IF Output Amplifier (U5 and U15)**

The 21.4 MHz signal from the Wideband/Narrowband Filter is stepped down in impedance through T3 and fed to U5 through R45 and R46. U5 output signal is then power split by the L11 and L12 network. E3 provides a 21.4 MHz Output to the rear of the module. C74 couples the signal to U15, which amplifies the signal before it is routed to the FM Demodulator Motherboard (A1A5). R45 is used to adjust the level of the 21.4 MHz signal.

3.3.1.3 **Video/Audio/COS (A1A3)**

Refer To **Figure 3-5**, the Video/Audio/COS (A1A3) Block Diagram and **Figure 6-7**, the Video/Audio/COS (A1A3) Schematic Diagram as aids in understanding the following description. As shown in **Figure 3-5**, the Video/Audio/COS (A1A3) consist of the following components: an AM Video Amplifier, a Video Output Amplifier, 2 Audio Amplifier/Lowpass Filters, a LOG SS Peak Detector, an SS Combiner/Amplifier, a COS Comparator, and a COR Amplifier.

3.3.1.3.1 **AM Video Amplifier (U2)**

AM/CW or SSB video signals from A1A5 are applied to the AM Video Amplifier at U2, pin 2. Adjustable Gain Buffer Amplifier (U2) provides an overall voltage gain of approximately 6. The output at U2, pin 6, drives the Audio Amplifier (U4D). This amplifier operates with a gain of 3. The audio output at U4, pin 14, passes through LPF L3 and C14 to the AM audio output. The output of U2, pin 6, is also sent to the input of the Analog Switch (U3A).

3.3.1.3.2 **FM Video Amplifier (U1)**

FM video signals from A1A5 are applied to the FM Video Amplifier at U1, Pin 2. Audio Amplifier (U1) has an overall voltage gain of approximately 4. The output at U1, pin 6, drives the Audio Amplifier (U4A) which operates with a gain of 3. The audio output at U4, pin 7, passes through LPF L1 and C3 to the FM audio output. The output of U1, pin 6, also drives the input to the Analog Switch (U3A).

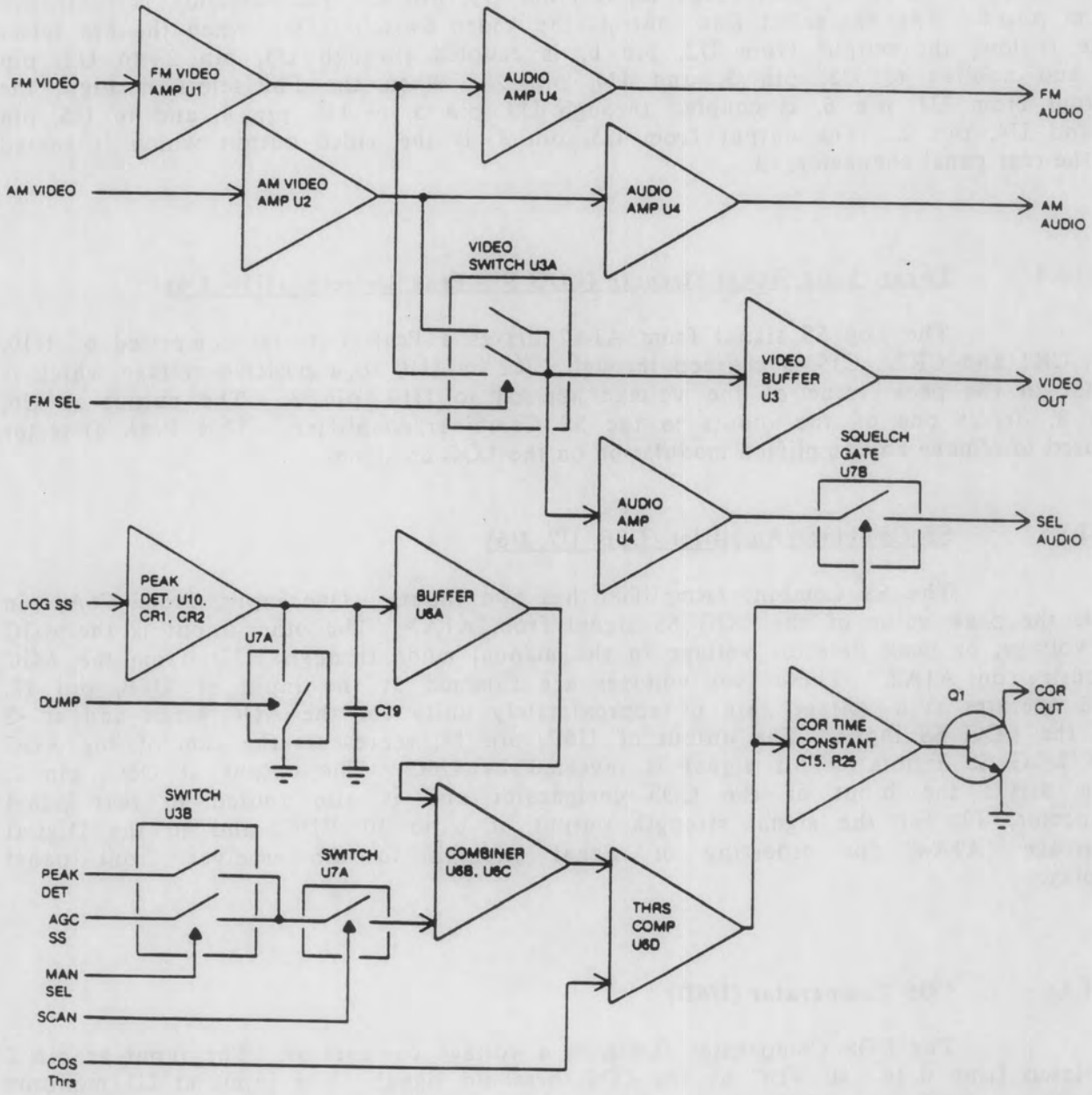


Figure 3-5. Video/Audio/COS (A1A3) Block Diagram

3.3.1.3.3 **Video Amplifier/Switch (U3, U5)**

The Video Amplifier selects on of two inputs: the AM video input from U2, pin 6; or the FM video input from U1, pin 6. The selection is controlled from A1A4. The FM select line controls the Video Switch (U3). When the FM select line is low, the output from U2, pin 6, is coupled through U3, pin 2, to U3, pin 3, and applied to U5, pin 3, and U4, pin 2. When the FM select is high, the output from U1, pin 6, is coupled through U3, pin 5, to U3, pin 4, and to U5, pin 3 and U4, pin 2. The output from U5, pin 8, is the video output which is routed to the rear panel connector, J3.

3.3.1.3.4 **Logarithmic Signal Strength (LOG SS) Peak Detector (U10, U6)**

The Log SS signal from A1A2 drives a Peak Detector comprised of U10, U6, CR1 and CR2. C19 is charged through CR2 by U10 to a positive voltage which is equal to the peak value of the voltage applied to U10, pin 3. The output at U6, pin 8, drives one of the inputs to the SS Combiner/Amplifier. This Peak Detector is used to remove any amplified modulation on the LOG SS signal.

3.3.1.3.5 **SS Combiner/Amplifier (U3B, U7, U6)**

The SS Combiner/Amplifier has two inputs. One input, from U6A, pin 8, is the peak value of the LOG SS signal from A1A2. The other input is the AGC SS voltage, or peak detector voltage in the manual mode through U3D, from the AGC circuitry on A1A2. These two voltages are summed at the input of U6B, pin 13. U6B operates at a voltage gain of approximately unity for the AGC input and at -2 for the LOG SS input. The output of U6B, pin 14, represents the sum of the AGC and LOG SS inputs. This signal is inverted by U6C. The output at U6C, pin 7, then drives the input of the COS comparator and is also routed to rear panel connector, J9, for the signal strength output of 0 to 10 VDC, and to the Digital Interface (A1A4) for reporting of signal strength to the receiver front panel display.

3.3.1.3.6 **COS Comparator (U6D)**

The COS Comparator (U6D) is a voltage comparator. The input at pin 2 is biased from 0 to +10 VDC by the COS threshold signal. The input at U3 monitors the voltage level from U6C, pin 7. The output at U6D drives the SEL AUDO Switch (U7B) and the COR Amplifier U4C. If the output at U6C, pin 7, exceeds the COS threshold, U6D, pin 1, is high. This closes pins 14 and 15 of U7B, passing the video signal from U3A, pins 3 and 4, through U4B, U7B, and LPF L4/C11 to the SEL AUDIO output. At the same time, U4C, pin 8, is high, saturating Q1 and clamping the COR OUT line to ground. If the output at U6C, pin 7, drops below the COS threshold, U6D, pin 1, goes low, opening switch U7B, and also turning off Q1 after a delay of approximately 3 seconds.

3.3.1.4 FM Demodulator Motherboard (A1A5)

Refer to **Figure 3-6**, the FM Demodulator Motherboard (A1A5) Block Diagram, and **Figure 6-5**, the FM Demodulator Motherboard (A1A5) Schematic Diagram as aids in understanding the following description. As shown in **Figure 3-6**, the FM Demodulator Motherboard (A1A5) consists of four FM Demodulator modules: an AM Video Multiplexer, an FM Video Multiplexer, and a Demod Select/Gain Adjust Multiplexer. The FM Demodulators provide FM demodulation and low-pass filtering of the 21.4 MHz IF signal and routing of the AM video signals through the AM video low pass filters.

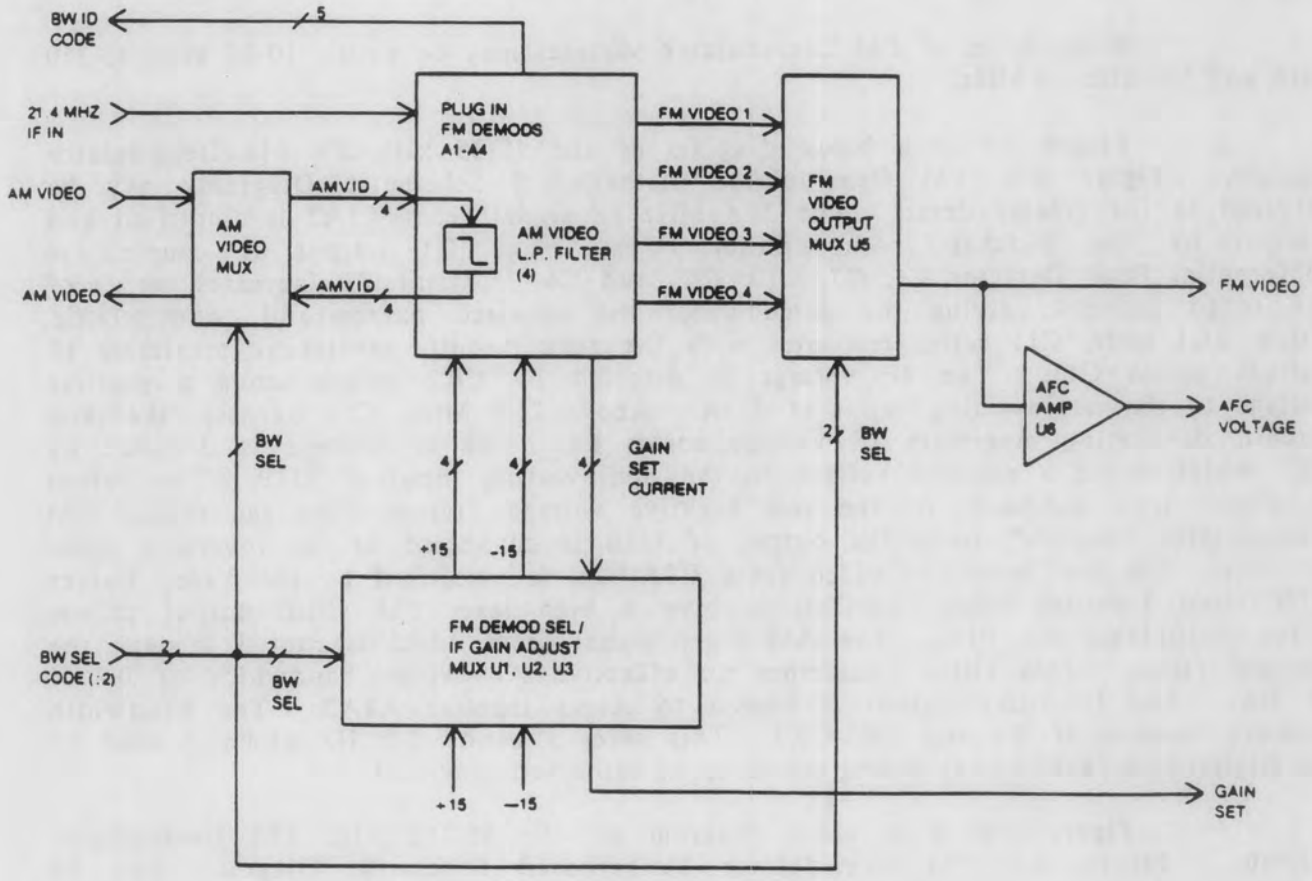


Figure 3-6. FM Demodulator Motherboard (A1A5) Block Diagram

3.3.1.4.1 **FM Demodulator Modules (A1A5A1 through A1A5A4)**

The FM Demodulator Modules (A1A5A1 through A1A5A4) have four different bandwidths, each corresponding to the bandwidth of a matching bandpass filter in A1A1. The 21.4 MHz IF input signal from A1A2 drives the common input to all four of the demodulator units on P3-1. These modules are field-changeable to accommodate different IF bandwidths.

When selected, each demodulator module is energized by a +15 VDC on P1-11 and -15 VDC on P2-1. This energizing voltage is provided by the Demod Select/Gain Adjust Multiplexer which decodes the BW Select Word from A1A4. Each demodulator module is assigned a 5-bit bandwidth ID code. During power up, the software initializing routine successively energizes the BW ID network on each demodulator module. The BW ID codes are then read back into the Digital Interface (A1A4) which keeps a record of the actual bandwidth of each module as installed.

Three types of FM Demodulator Modules may be used: 10-25 kHz, 30-250 kHz, and 250 kHz - 4 MHz.

Figure 3-7 is a block diagram of the 10-25 kHz BW FM Demodulator Module. **Figure 6-5**, FM Demodulator Motherboard Schematic Diagram, may be referred to for greater detail. The 21.4 MHz IF signal from A1A2 is amplified and limited by the Wideband Amp/Limiter (U1). The U1 output is coupled to differential Peak Detector L1, C7, C10, C11 and C6. Crystal Y1 increases the Q of the tuned network, giving the demodulator the required narrowband characteristic. Below 21.4 MHz, C11 series resonates with the tank circuit, developing maximum IF voltage across C11. The IF voltage is detected by CR2 which sends a positive voltage to the noninverting input of U2A. Above 21.4 MHz, C11 bypasses the tank circuit, developing maximum IF voltage across L1. The IF voltage is detected by CR1 which sends a positive voltage to the noninverting input of U2B. The output at U2A-1 is a composite of the two negative voltages, representing the typical FM Demodulator "S-curve", since the output of U2B is connected to the inverting input of U2A. The low level FM video from U2A-U2B is amplified by the Video Buffer (U2C) and Lowpass Filter (L4-C20) to give a high level FM video output to the video multiplexer via P1-2. The AM video signal from A1A2 is routed through the lowpass filter. This filter establishes an effective AM video bandwidth of 0.7 X IF BW. The IF filter output is routed to A1A3 through A1A2. The bandwidth network consists of R3 and CR3-CR7. This gives a bandwidth ID which is read by the Digital Interface (A1A4) during power up, as explained previously.

Figure 3-8 is a block diagram of the 30-250 kHz FM Demodulator Module. **Figure 6-5**, FM Demodulator Motherboard Schematic Diagram, may be referred to for greater detail. The 21.4 MHz IF input signal from A1A2 is amplified and limited by the Wideband Amp/Limiter (U1). The U1 output is coupled to differential Peak Detector L1, C7, C8, and C6. Below 21.4 MHz, C11 series resonates with the tank circuit, developing maximum IF voltage across C11. The IF voltage is detected by CR2, which sends a negative voltage to the noninverting input of U2A. Above 21.4 MHz, C11 bypasses the tank circuit, developing maximum IF voltage across L1. The IF voltage is detected by CR1, which sends a negative voltage to the noninverting input of U2B. The output at U2A-1 is a composite of the two negative voltages, representing the typical FM Demodulator "S-curve".

3.3.1.4.1 **FM Demodulator Modules (A1A5A1 through A1A5A4) - (Continued)**

The low level FM video from U2A-U2B is amplified by the Video Buffer (U2C) and Lowpass Filter (L4-C20) to give a high level FM video output to the video multiplexer via P1-2. The AM video signal from A1A2 is routed through the lowpass filter. This filter establishes an effective AM video bandwidth of 0.7 x IF BW. The filter output is routed to A1A3 through A1A2. The bandwidth ID network consists of R3 and CR5-CR7. This gives a bandwidth ID which is read by the Digital Interface (A1A4) during power up, as explained previously.

Figure 3-9 is a block diagram of the 250 kHz - 4 MHz BW FM Demodulator Module. **Figure 6-5**, FM Demodulator Motherboard (A1A5) Schematic Diagram, may be referred to for greater detail. The 21.4 MHz IF input signal from A2A2 is amplified and limited by the Wideband Amp/Limiter (U1). The IF output from U1 is applied to the Discriminator. The Discriminator is center-tuned at 21.4 MHz and establishes the necessary phase shifts to convert the wideband FM to amplitude variations. These variations are detected by CR1 and CR2 and amplified by the Video Buffer (U2). They are lowpass-filtered at 1/2 the IF bandwidth by L2 and C14 to give a high level FM video output to the video multiplexer via P1-2. The AM video signal from A1A2 is lowpass-filtered by L3 and C5 to approximately 0.7 times the selected IF bandwidth. The filter output is routed back through A1A2 to A1A3 for video and audio outputs. The bandwidth ID network consists of R11, R12, and combinations of diodes CR3 through CR7.

The video outputs from the four FM Demodulators are routed through the video multiplexer and are explained in **paragraph 3.3.1.4.3**. The AM video outputs from the four FM demodulators are routed through the AM video multiplexer and are explained in **paragraph 3.3.1.4.2**.

Each FM Demodulator module also provides a fixed gain set current output to A1A1U4. The current is derived from the +15 VDC supply through a dropping resistor (R16-narowband, R13-wideband.) The gain set current appears at P1-3 of the active FM demodulator module and is routed through the Demod Select/Gain Adjust Multiplexer. It is then sent through A1A5P5 to A1P1, where it provides gain bandwidth compensation by adjusting the gain of A1A1U4 for the installed IF bandwidth.

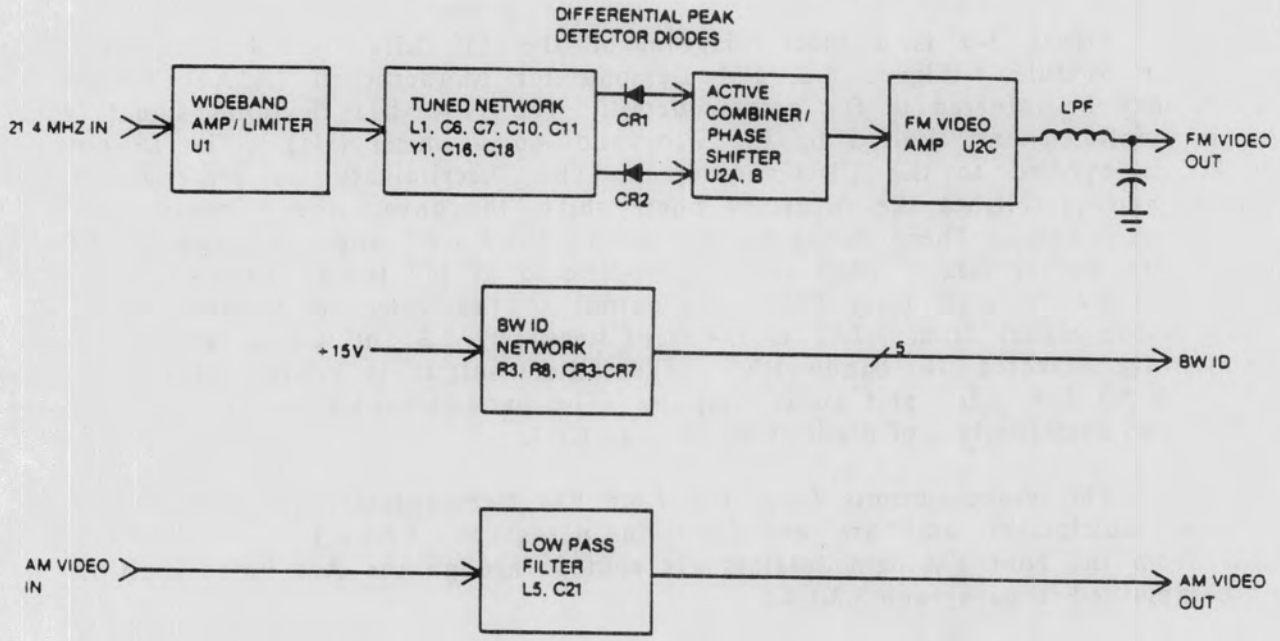


Figure 3-7. FM Demodulator (10-25 kHz BW) Block Diagram

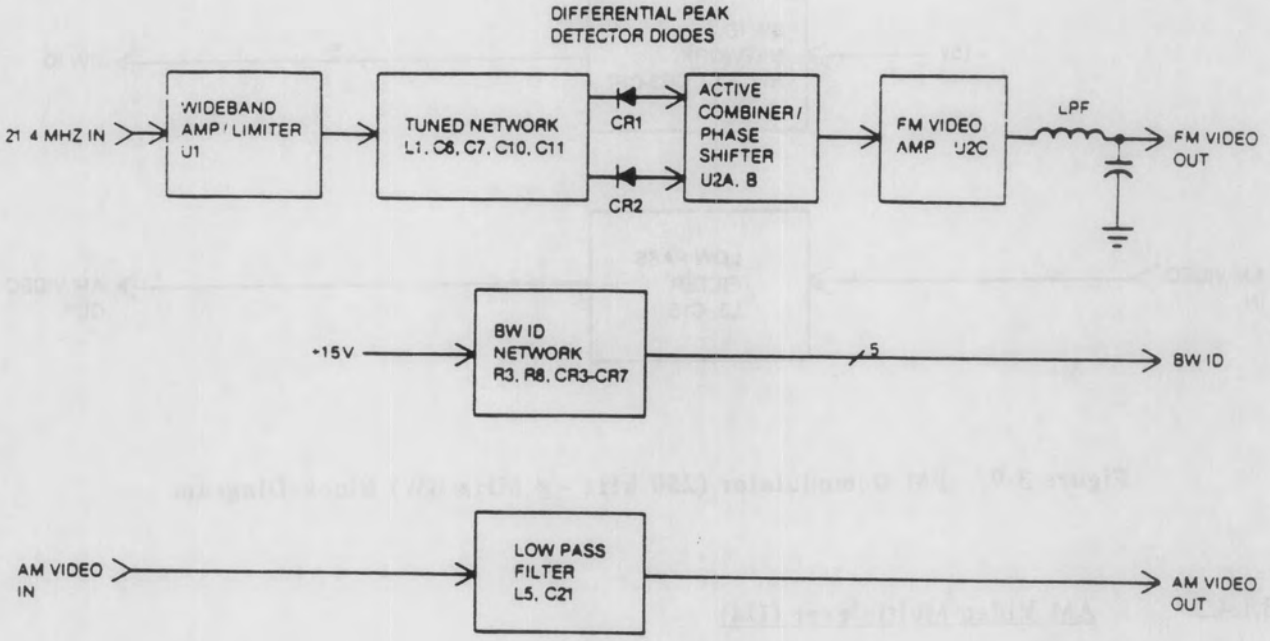


Figure 3-8. FM Demodulator (25-250 kHz BW) Block Diagram

FIGURE 3-9 WJ 9040 IFD220 IF DEMODULATOR

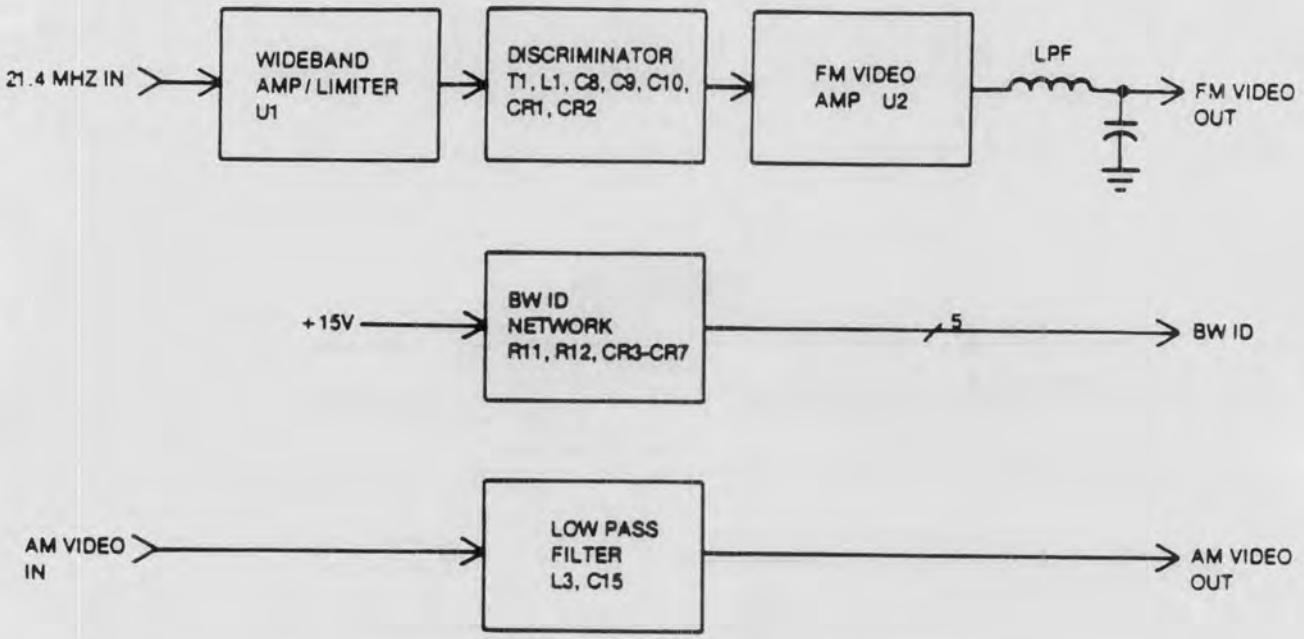


Figure 3-9. FM Demodulator (250 kHz - 4 MHz BW) Block Diagram

3.3.1.4.2 <u>AM Video Multiplexer (U4)</u>

The AM Video Multiplexer (U4) is a two-section addressable analog multiplexer. The address inputs enter on pins 9 and 10 and are driven by the bandwidth code from A1A4. This two-bit code enters U4, which has two separate sections. Each section has one analog input and four analog outputs. The two address inputs, therefore, select one of the four outputs. The multiplexer routes the AM video input to the selected FM Demodulator for AM video filtering and then routes the output of the lowpass filter to the AM video output P2.

If a code of 00 exists at the inputs, output number one is selected (U4, pins 1 and 12). If a code of 01 is received at the input pins, output number two is selected (U4, pins 5 and 14). If a 10 is received, output number three is selected (U4, pins 2 and 15). If an 11 is received at the input pins, output number four is selected (U4, pins 4 and 7). U4, pin 3, is the AM video input from A1A2 and the signal goes through that half of U4 and the AM video signal appears at pins 1, 5, 2, or 4 as selected by pins 9 and 10 (address inputs).

Assuming an address code of 00 is received at input pins 9 and 10, the AM video through pin 3 appears at U14, pin 1, and goes to P1, pin 9, on the Demodulator Module, A1. Internally, it is lowpass-filtered in A1 and appears on P1, pin 10, to U4, pin 12. Pin 12 is connected to pin 13 (since the input was 00), and the output is sent through A1A2 to Video/Audio/COS (A1A3) as the filtered AM video signal.

3.3.1.4.3 **FM Video Output Multiplexer (U5) and U6)**

The FM Video Output Multiplexer is composed of the Analog Switch (U5) and Buffer Amplifier (U6). U5 is an analog multiplexer with two address inputs at pins 10 and 9, which are driven from the bandwidth select code from A1A4. U5 has four FM video inputs (pins 1, 5, 2, 4) and single output at pin 3. A code of 00 on pins 10 and 9 connects pin 1 to 3. A code of 01 connects pin 2 to pin 3. A code of 10 connects pin 5 to pin 3. And, a code of 11 connects pin 4 to pin 3.

Multiplexer (U5) receives video signals from the four FM Demodulator units, with one being active at a time. An input of 00 to pins 10 and 9 of U5 means that the FM video output of module A1 (P1, pin 2) goes to U5, pin 1, through U5, pin 3. The signal is then routed through A5P1 and A1A2 to Video/Audio/COS (A1A3). The signal also goes to Buffer Amplifier (U6) a high-gain DC-coupled buffer amplifier (operating as a lowpass filter). The output of U6, pin 6, is used as an AFC voltage to generate an error correction voltage to the host unit (external) driving the demodulator.

3.3.1.4.4 **Demod Select/Gain Adjust Multiplexer (U1, U2, U3)**

The Demod Select/Gain Adjustment Multiplexer performs two functions. The first function is to select one of four demodulator's to be active and the second function is to route the selected demodulator's gain adjust output current through the gain adjust line to A1A1.

U2 switches a gain set current established on the FM Demodulator, selected with the BW codes of J1 (pins 3 and 4), through U2 to U4 on A1 for gain-bandwidth compensation. U1 and U3 supply +/- 15 VDC to the selected FM Demodulator. Half of U1 energizes FM Demod #1, and the other half energizes FM Demod #2. U3 energizes FM Demods #3 and #4. U1, U2, and U3 are all controlled by the BW Code lines on J1 (pins 3 and 4).

3.3.1.5 **Digital Interface (A1A4)**

Refer to **Figure 3-15**, the Digital Interface (A1A4) Block Diagram, and **Figure 6-4**, Digital Interface (A1A4) Schematic Diagram, as aids in understanding the following description. As shown in **Figure 3-15**, the Digital Interface

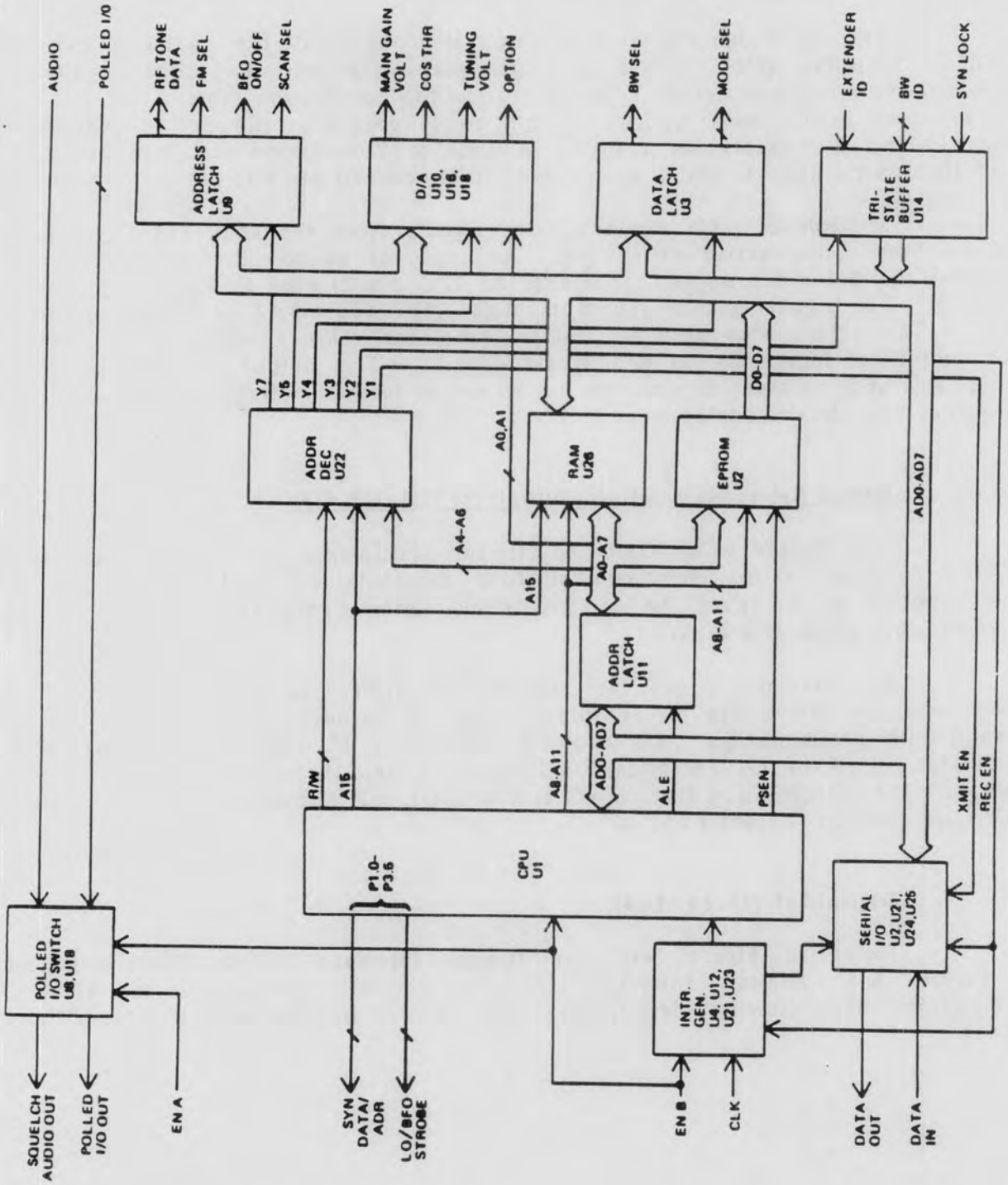


Figure 3-10. Digital Interface (A1A4) Block Diagram

3.3.1.5 **Digital Interface (A1A4) - (Continued)**

(A1A4) is a single printed circuit card consisting of a CPU, Address Latch, EPROM, Address Decoder, Serial I/O, Interrupt Circuit, D to A Converter, BW/Mode Latch, BW ID Buffer, RF Tune Address Latch, and a Polled I/O Analog Switch.

3.3.1.5.1 **CPU (U1)**

The CPU (U1) is an 8031 CMOS Microcontroller (CPU) containing 128 bytes of internal RAM. It requires an external ROM for proper operation. It operates at a 10 MHz rate, determined by crystal Y1, and has a 1.2 microsecond instruction cycle. The CPU is a self-contained device with the exception of an external EPROM which contains the system operating software.

The RC circuit U20, R5, R6, C11, C12, connected to the CPU Reset Input, pin 9, pulses high when power is applied to the Digital Interface (A1A4). This resets all the internal hardware registers and starts the CPU addresses to 00. The program then performs an initialization routine which sends data to and initializes the CPU. The CPU has four 8-bit I/O ports, P0 through P3. The initialization routine determines the functions of each of these ports.

A total of 11 bits of data (P1.0 through P1.7 and P3.0, P3.4 and P3.5) are configured for the synthesizer tuning data I/O port. This port sends the synthesizer data from the CPU to the Synthesizer via the SYN Data/Address Bus.

The INT 0 (P3.2) and INT 1 (P3.3) signals are used when the WJ 9040 I/O Bus is in the remote control.

The PO port (a bidirectional address/data bus) allows the CPU to communicate with the circuitry on or off the card using the WJ 9040 I/O bus. The PO port contains 8 address lines, AD0 through AD7, but 13 address lines are necessary for addressing within the Demodulator. The remaining 5 address lines (A8-A11 and A15) defined as P2, complete the necessary address lines for the CPU. A12, P2.4 through A14, P2.6 are not used.

The REM/SEL output, P3.1, is used (local when high, remote when low) to control COS and IF gain analog switches.

The RD (P3.7), and WR (P3.6), lines are used only for internal data transfers with A1A4.

The ALE (Address Latch Enable) output is toggled from a high to a low to clock valid address data out on the AD0-AD7 lines. Address latched U2 hold the valid address for one complete cycle.

The PSEN line is used during an opcode fetch from the EPROM (U2). When a transfer is required, the PSEN momentarily goes low and data is transferred from the EPROM (U2) to the CPU.

3.3.1.5.1 **CPU (U1) - (Continued)**

The address data bus is an 8-bit bus connecting several devices on the card. The outputs for U1, U2, and U4 are tri-state outputs (when these devices are not active, they are disconnected from the address bus). Only one of these devices may be active at a time.

3.3.1.5.2 **Address Latch (U11)**

The Address Latch (U11) is an 8-bit latch which holds an address coming from U1 while a specific operation is being performed. The AD0-AD7 outputs are not valid for an entire bus cycle, so that the address latch must hold this address by activating the ALE signal to a high then a low level. This action transfers the D inputs to the Q outputs which remain until a new address is sent to U2. The outputs of U11 drive the address inputs to U22 (A,B,C) and U2 (A0 to A7), the DAC A/DAC B input to U6, and address latch U26.

3.3.1.5.3 **EPROM (U2)**

The EPROM (U2) contains a 4K x 8 memory. It has an input address range of 0000 to FFFF. The EPROM (U2) also has an 8-bit data bus output Q0 to Q7. The eight lower address bits are received directly from U2 and the upper four bits are received from U1.

In a typical operation, an address is presented to U2 (AD0 through AD7 plus A8 through A11) by the CPU. With a valid address present at U3, the CPU pulses the PSEN line to a low and the addressed memory data is available at the outputs of Q0 to Q7 to be placed on the address data bus. The Q0 to Q7 outputs are only present on the bus while the PSEN line is held low.

3.3.1.5.4 **Address Decoder (U22)**

The Address Decoder (U22) is used to define external I/O operations. The address decoder is used to select data transmit or receive through the serial I/O circuit, to activate the BW I.D. buffer, to activate the BW mode select latch, to activate the D/A converter, and to activate the Address latch (U26).

3.3.1.5.4 **Address Decoder (U22) - (Continued)**

Decoder U22 is a 3-bit to 8-bit decoder addressed by three binary bits on inputs A, B, and C. The input value has a range of 000 to 111. With 000 placed on the A, B, and C inputs, the Y0 output would go low. With 001 on the input lines, Y1 would be active and so on. Refer to the following example:

Inputs A B C	Output Activate
0 0 0	Y0
0 0 1	Y1
0 1 0	Y2
0 1 1	Y3
1 0 0	Y4
1 0 1	Y5
1 1 0	Y6
1 1 1	Y7

The G2A enable input is driven by the RD and WR lines from U1 and is used to enable U22.

The A, B, and C address inputs are driven by bits A4, A5, and A6 from the address outputs of U11. While U11 has 16 address bits, the least significant eight are used for external device addressing.

To utilize U22, U1 sends and address over the AD0 to AD7 lines, latch it through U11, and on to U22. Two outputs on U22 are not being used: Y0 and Y6. The first valid output on U22 is, therefore, Y1. Y1 is the transmit enable line to the serial I/O circuitry. To activate Y1, 0000 (Q0-A3) and 1000 (Q4-Q7), which equals 10 in hexadecimal is sent from U11 to U22. Simply stated, a hexadecimal address of 10 is sent from the CPU, through U11 to U22, activating the Y1 output. The Y2 output (serial I/O receiver enable line) is activated when a hex address of 20 is received from U11. The Y3 output to the tri-state buffer is activated when a hexadecimal address of 30 is received from U11. The Y4 output to the BW mode select latch is selected when a hex address of 40 is received. The Y5 output selects the A portion of the D/A converter (U6) when a hex address of 70 is received from U11. With a hex address of 50 (Y7 from U22 and Q2 from U11) the B portion of the D/A converter will be selected. The Y0 through Y7 outputs are active low signals. The Y7 output selects U26 when a hex address of 74 is received from U11.

3.3.1.5.4 **Address Decoder (U22) - (Continued**

Hex Address	U8 Outputs
10	Write Data/Transmit Enable to Serial I/O Circuit
20	Receive Enable/Read Data to Serial I/O Circuit
30	Enable B/W ID Buffer (U4)
40	Enable Mode BW Latch (U5)
50	Enable Address Latch (U26)
70	Enable D/A Converter Section A
74	Enable D/A Converter Section B

3.3.1.5.5 **Interrupt (INT0 and INT1)**

Data transfers between the demodulator and an external controller are serial synchronous and are made up of three signals: CLK, Enable B, and Data (Input or Output). The CLK and Enable signals are used to interrupt the CPU so that a data transfer function may be performed.

The eight clocks interrupt circuit consists of AND Gate U21B, counter U4, and an inverter U23. Data is clocked in or out eight bits at a time. Counter U4's output is inverted and on the following edge of the eight count interrupts the CPU to read or write the data byte. When a data read is performed the U4 counter is reset to 0 and is ready for another byte of data.

The Enable B Input INT1 is high to low edge triggered interrupt. When the Enable B signal goes high to enable the data transfer and then returns low at the end of the data message, the CPU stops what it is currently doing and performs the function according to the message received.

3.3.1.5.6 **Serial I/O (U2, U21, U24, U25)**

The serial I/O is a bidirectional parallel-to-serial, serial-to-parallel transmitter/receiver circuit consisting of U25, a serial-to-parallel converter, and U24, a parallel-to-serial converter. Both U24 and U25 are driven by a gated CLK (U21B) with U24 enabled by the transmit enable line Y1 from U22 and U25 enabled by the receive enable line Y2 from U22.

When the data is received from the EFR100 I/O, enable B goes high and eight clocks are received causing the data to be clocked into the device U25. The input INT0 goes low, interrupting the CPU to read a byte of data from serial to parallel device U25 by the Y2 output of U22. After the last byte of data has been received, the Enable B signal INT1 is reset and notifies the CPU to process the data received.

3.3.1.5.6 **Serial I/O (U2, U21, U24, U25) - (Continued)**

A data transfer to the EFR100 I/O is a similar function. A data byte is loaded into the parallel-to-serial device, U24, by the Y1 output of U22. Enable B goes high and eight clocks are received shifting the serial data out. This interrupts the CPU to load up another byte of data for the EFR100 I/O to read or an Enable B interrupt occurs to finish the cycle.

3.3.1.5.7 **D/A Converter (U10)**

The D/A Converter (U10) and analog switches U21A and U21B are used to control IF gain, set COS threshold voltage, and generate tuning voltage for the RF Tuner.

The D/A Converter has 8 data bits at its input lines D0 through D7 and voltage outputs at VA, VB, VC, and VD. If all of the data inputs are low, the output is equal to 0 VDC. If the data inputs are all high, the output is 2.5 Vdc. Each one-bit increment or change at the input causes the voltage to change by approximately 10 millivolts. The outputs at VA, VB, VC, and VD are amplified BY U16 and U18 to produce a voltage range at each output of 0 to +10 VDC. The VA, VB, VC, and VD outputs are selected by the A0 and A1 inputs and are enabled by WR.

3.3.1.5.8 **Bandwidth/Mode Latch (U3)**

The Bandwidth/Mode Latch (U3) is an 8-bit octal latch similar to the Address Latch (U11). Inputs to U3 consist of eight bits from the data bus (AD0 through AD7). The Q1 through Q4, Q6, and Q7 outputs of U3 are used to define the mode and bandwidth selection for the IF processing section and exit the Digital Interface (A1A4) card via J3. The Q0 output is a Read Request bit to let the Controller know when a Demodulator needs service. It is sent to the polled I/O Switch (U8). The Q5 output exists the card to produce the DUMP signal.

In a typical operation, the CPU (U1) examines the front panel data from the Digital Interface (A1A4) every 3 milliseconds. If there is a change in the front panel inputs, the CPU puts the BW/mode select data word on the data bus to the D inputs of U3. The new BW/mode data is latched to the Q outputs and connected to the IF Demodulator (A1) when the address decoder U22, Y4 output goes from a low to a high.

3.3.1.5.9 **Bandwidth I.D. Buffer (U14)**

The Bandwidth I.D. is the unique code assigned to each of the four Demodulator Modules as explained in **paragraph 3.3.1.4.1.**

During the power-up initialization routine, the CPU examines each of the four FM Demodulator modules and reads the BW I.D. present on each card. The BW I.D. is brought in through U14 and placed on the data bus to the CPU memory. This way, the CPU knows which FM Demodulator to energize when it receives the request from one of the four bandwidths.

3.3.1.5.9 **Bandwidth I.D. Buffer (U14) - (Continued)**

Five inputs (U4 pins, 2, 4, 6 and 11) comprise the BW I.D. information. During the initialization routine, the CPU selects the FM Demodulator #1. The BW I.D. code enters U14 which is selected by the Y3 output of U8 (hexadecimal address of 30). The BW I.D. information is then placed on the data bus (AD0 through AD4). The BW I.D. of FM Demodulator #1 is then transferred into the memory of the CPU. BW I.D.'s #2, #3, and #4 are similarly processed.

Inputs 13 and 15 are used to read the Frequency Extender ID and Synthesizer Lock bits into the CPU. These are read via bits AD5 and AD6 respectively.

The BW I.D. code is also used to define a configurator, a 16-bit data word that defines this unit, i.e., operating frequency range, bandwidths available, etc. It is used by the WJ 9040 System Controller so that the controller can identify what this units is, what it contains, and its purpose in the system, i.e., which demodulator and what its bandwidths are.

3.3.1.5.10 **Polled I/O Switch (U8)**

The Polled I/O Switch (U8) is used by the WJ 9040 System Controller to extract information from the demodulator using the Enable A and Enable B inputs. The Enable B input transfers the READ REQ, SIG STR, and COS STATUS (J1, pin 20, 18, 25) to the polled I/O bus to the IOM108. The COS STATUS is not used in this unit.

The SIG STR entering from J2, pin 7, would be passed through U8, pin 6, to J1, pin 29, to the IOM108 when energized by the Enable B input. The COS STATUS output from J2, pin 5, is connected to U8, pin 1. When the Enable B signal enables U11, the COS STATUS is then connected to the bus through U8, pin 11, to J1, pin 26.

The SEL AUDIO entering from J2, pin 6 is passed through U18, pin 3, to the IOM108 via J1, pin 32, when U8 is energized by the Enable A. The Enable A signal is only active for the demodulator that has been selected by the IOM108. AFC from J4, pin 10, is passed through U8, pin 14, to J1, pin 30, when U8 is energized by the EN B signal.

3.3.1.5.11 **Tune Data/Mode Latch (U9)**

The Tune Data/Mode Latch (U9) is an 8-bit octal latch similar to the Address Latch (U11). Inputs to U9 consist of eight bits from the data bus (AD0-AD7) and the Y7 output of U22. The Q0 and Q1 outputs of U9 are the FM and SCAN SEL signals. QZ selects the BFO. Q3 selects HI or LO BAND tuning. Q4-Q7 are the RF and LO band switch signals. Data on the data bus is latched through U9 to the Q0-Q7 outputs when the address decoder U22, Y7 output goes from low to high.

3.3.2 LED FLEXIBLE BOARD (A2)

Refer to Figure 6-6, LED Flexible Board (A2) Schematic Diagram, and **Figure 6-7,** WJ 9040 IFD220 IF Demodulator Main Chassis Schematic Diagram, during the following discussion.

When power is applied to the unit a voltage is applied from the Digital Interface (A1A4) through J5 (pins 5 and 6) to light the Red POWER Indicator on the front panel of the unit.

When the Receiver selects a bandwidth that activates the IFD220 a voltage is applied from the Digital Interface (A1A4) through J5 (pins 3 and 4) to light the Amber ACTIVE Indicator on the front panel of the unit.

When the signal strength of the tuned signal is greater that the Squelch Threshold a voltage is applied from the Digital Interface (A1A4) through J5 (pins 1 and 2) to light the Green SQUELCH Indicator on the front panel of the unit.

SECTION IV

MAINTENANCE

4.1 GENERAL

This section provides detailed procedures to perform preventive and corrective maintenance on the WJ 9040 IFD220 IF Demodulator. Preventive maintenance helps prevent malfunctions or breakdowns. Corrective maintenance includes procedures for returning a malfunctioning Direction Finding Antenna to operating condition.

4.2 PREVENTIVE MAINTENANCE

Preventive maintenance consists of visual inspection, cleaning and lubrication. Although the WJ 9040 IFD220 IF Demodulator is designed for extended operation with little or no routine servicing, optimum long-term performance can only be achieved by a periodic preventive maintenance schedule. **Table 4-1** is a recommended schedule for performing preventive procedures.

Table 4-1. Preventive Maintenance Schedule

Procedure	Interval	Comments
Cleaning	60 days	Interval variable depending on the operating environment.
Inspection for damage	60 days	Interval variable depending on operating environment and equipment use.
Performance Tests	180 days	Interval variable depending on operating environment and equipment use.

4.3 VISUAL INSPECTION

Many potential or existing faults can be detected by making a visual inspection of the unit. For this reason, a complete visual inspection should be made on a routine basis and whenever the unit is inoperative. At a minimum, the unit should be inspected for the following items:

1. Inspect the cover, enclosure and front panel for condition of finish and panel markings.
2. Inspect for dents, punctures, or warped areas.
3. Inspect for loose or missing screws or washers.
4. Inspect the receptacles for condition of pins, contacts, and mountings.
5. Inspect the internal components for signs of deterioration, discoloration or charring. Check for melted insulation and damaged, cracked, or broken components.
6. Inspect the PC connectors, interface connectors, and chassis wiring for excessive wear, looseness, misalignment, corrosion, or other signs of deterioration.

4.4 CLEANING

Perform cleaning to remove accumulated dust and other contamination, and to ensure trouble-free operation.

CAUTION

Avoid the use of chemical cleaning agents containing benzene, toluene, xylene, acetone or similar solvents. These chemicals may damage the plastics used in the unit.

1. Exterior - Dust the cabinet with a soft cloth or a small soft-bristled paint brush. Dirt clinging to the cabinet may be removed with a clean lint-free cloth dampened with a mild detergent and water solution. Avoid using abrasive cleaners. They will scratch the finish.
2. Interior - Dust in the interior of the unit should be removed before it builds up enough to cause arcing and short circuits during periods of high humidity. Dust is best removed by dry, low-pressure air. Dirt on surfaces may be removed with a soft-bristled paint brush or a clean, lint-free cloth dampened with a mild detergent and water solution. Use a cotton tipped applicator for cleaning in narrow spaces and on the circuit boards.

4.5 LUBRICATION

Lubrication is not required for the WJ 9040 IFD220 IF Demodulator.

4.6 IFD220 IF DEMODULATOR TESTING AND TROUBLESHOOTING

The testing and troubleshooting procedures outlined in the following paragraphs define the minimum performance standards that ensure the IFD220 IF Demodulator functions properly in all normal operating modes. The tests should be used for the initial inspection, for preventive maintenance checks, for troubleshooting or to verify unit performance after repairs have been made.

4.7 TEST EQUIPMENT REQUIRED

Table 4-2 lists the test equipment required for maintenance of the WJ 9040 IFD220 IF Demodulator. Equivalent equipment may be used.

Table 4-2. Test Equipment Required

Instrument Type	Recommended Instrument
Test Bed (EFR100, IOM108, WJ-8628-4 Receiver or Remote Controller)	
Signal Generator	HP8640B
Oscilloscope	HP180C
Digital Voltmeter	Fluke 8100A
RF Voltmeter	Boonton 92B
EFR100 Frame Extender Cable (2)	WJ Part @ 271408
Frequency Counter	HP-5303A

4.8 IFD220 TEST PROCEDURES

The test procedures contained in the following paragraph require that the IFD220 IF Demodulator be controlled by the WJ-8628-4 Receiver, or equivalent Remote Control Device. More detailed information concerning the WJ-8628-4 Receiver Operation and Test Procedures may be found in the **WJ-8628-4 Receiver Instruction Manual**. During the following test procedures the "Receiver or Remote Controller" will be referred to as the "Receiver". Refer to **Table 4-3** for IFD220 minimum performance standards.

Table 4-3. Minimum Peformance Standards

Parameter to be Tested	Performance Standard
RF/IF Gain, RF IN to RF OUT	IF BW / GAIN 2.85 kHz +85 dB 10 kHz +83 dB 20 kHz +80 dB 50 kHz +76 dB 100 kHz +73 dB 200 kHz +70 dB 500 kHz +66 dB 1 MHz +63 dB 2 MHz +60 dB 4 MHz +57 dB 8 MHz +53 dB
Video Output	350 mVrms minimum into 75 with input level at AGC Threshold, 50% AM at 400 Hz, or 30% X IF BW Peak Deviation in FM Mode.

Perform the following preliminary setup procedure prior to beginning any of the the tests addressed in the following paragraphs.

1. Deenergize the IFD220.
2. Remove the IFD220 from the EFR100 Equipment Frame.
3. Remove the covers to provide access to the IFD220 Modules.
4. Connect J1 on the rear panel to its mating connecotr of the EFR100 Equipment Frame.
5. Connect the 9-pin SRE Auxilliary Connector from the Receiver or the Remote Controller to J5.
6. Unless otherwise noted in the test procedure, connect the Receiver SM or pre-filtered IF Output to J4.

4.8.1 21.4 MHz BANDPASS AMPLIFIER (A1A1) TESTING AND TROUBLESHOOTING

A Signal Generator, an RF Voltmeter, and an Oscilloscope (see **Table 4-2**) are required to perform the tests outlined below.

4.8.1.1 Test Setup Procedure

The following test setup procedure should be performed prior to testing or troubleshooting the 21.4 MHz Bandpass Amplifier (A1A1):

1. Perform the preliminary test setup procedure (see **paragraph 4.8**).

2. Connect the Signal Generator to J4.

3. Set the Signal Generator as follows:

   a. RF Frequency 21.4 MHz
   b. Output Level -40 dBm
   c. Modulation None

4. Energize the Receiver and the IFD220. Use the Receiver controls to set up the following parameters:

   a. MAN/AGC MAN
   b. RF Gain Maximum
   c. DET MODE AM
   d. IF BW Narrowest IFD220 Bandwidth

5. Use the RF Voltmeter to verify that a 2.25 mVrms signal is present at A1A1E1. Adjust the signal generator output level slightly as necessary to achieve the correct signal level.

4.8.1.2 Testing and Troubleshooting Procedure

The testing and troubleshooting information contained in this paragraph is keyed to **Table 4-4**, 21.4 MHz Bandpass Amplifier (A1A1) Fault Isolation Table. This table is used to isolate the module fault to a defective stage or circuit. Perfrom the following procedures in the sequence given.

1. Us an RF Voltmeter RF Probe Tip or Oscilloscope to check each test point listed in **Table 4-4**.

2. When a faulty component is found refer to **paragraph 4.9**, Parts Replacement Guidlines for replacement of faulty PC Board Components.

3. Replacemnt of the indicated key component(s) will normally restore the faulty test point signal to a normal level. If a faulty signal is still observed, additional signal tracing/fault isolation will be necessary. Refer to the appropriate Circuit Description in **Section III** and appropriate Schematic Diagram in **Section VI**.

Table 4-4. 21.4 MHz Bandpass Amplifier (A1A1) Fault Isolation Table

Test Point	Normal Signal	Key Components	Comments
U1-3	2.25 mv RMS	U1	Adjust signal generator level to correct level
Q1-2	2.0 mv RMS	U1	Also check for Plus 13 V at U1-1
Q1-1	13 mv	Q1, Q2	
Q2-1	0.8 Vdc	Q1, Q2	Q1 sets bias for Q2
CR7 cathode	6 mv RMS	CR7	Test may be run on any selected BW. Turn signal generator off for DCVM measurements.
CR7 anode	6 mv RMS	CR7	
CR12 cathode	6 mv RMS	CR12	
CR12 anode	6 mv RMS	CR12	
E2	-39 dB	SSB	See **Table 4-4a** for input level as a function of BW for this test. Check all BWs for correct gain at E2.
E2	-39 dB	10 kHz	
E2	-31 dB	20 kHz	
E2	-32 dB	50 kHz	
E2	-29 dB	100 kHz	
E2	-26 dB	200 kHz	
E2	-24 dB	300 kHz	
E2	-22 dB	500 kHz	
E2	-19 dB	10 MHz	
E2	-16 dB	2 MHz	
E2	-13 dB	4 MHz	
E2	-10 dB	8 MHz	

Table 4-4a. Input Levels

BW	Input Level
SSB	-90 dBm
10 kHz	-90 dBm
20 kHz	-87 dBm
50 kHz	-83 dBm
100 kHz	-80 dBm
200 kHz	-77 dBm
300 kHz	-75 dBm
500 kHz	-73 dBm
1 MHz	-70 dBm
2 MHz	-67 dBm
4 MHz	-64 dBm
8 MHz	-61 dBm

4.8.2 AM/SSB/CW DEMODULATOR (A1A2) TESTING AND TROUBLESHOOTING

A Signal Generator, an RF Voltmeter, and an Oscilloscope (See **Table 4-2**) are required to perform the tests outlined below. Testing and troubleshooting of the AM/SSB/CW Demodulator (A1A2) consists of two different procedures: one procedure for the IF section and one procedure for the AGC section. These procedures may be performed independently, although it is advised to verify proper IF section operation prior to performing the AGC section procedure.

4.8.2.1 **IF Test Setup Procedure**

The following test setup procedure should be performed prior to testing or troubleshooting the AM/SSB/CW Demodulator:

1. Perform the preliminary test setup procedure (see **paragraph 4.8**).

2. Connect the Signal Generator to A1A2E1.

3. Set the Signal Generator as follows:

   a. RF Frequency 21.4 MHz
   b. Output Level -50 dBm
   c. Modulation None

4. Energize the Receiver and the IFD220. Use the Receiver controls to set up the following parameters:

   a. MAN/AGC MAN
   b. RF Gain Maximum
   c. DET MODE AM
   d. IF BW select asn IFD220 BW

5. Use the RF Voltmeter to verify that 360 mVrms signal is present at A1A2R9. Adjust the Signal Generator output level slightly as necessary to achieve the correct signal level.

4.8.2.2 **IF Testing and Troubleshooting Procedure**

The testing and troubleshooting information contained in this paragraph is keyed to **Table 4-5**, AM/SSB/CW Demodulator (A1A2) Fault Isolation Table (IF Section). This table is used to isolate the module fault to a defective stage or circuit. Perfrom the following procedures in the sequence given.

1. Us an RF Voltmeter RF Probe Tip or Oscilloscope to check each test point listed in **Table 4-5**.

2. When a faulty component is found refer to **paragraph 4.9**, Parts Replacement Guidlines for replacement of faulty PC Board Components.

3. Replacemnt of the indicated key component(s) will normally restore the faulty test point signal to a normal level. If a faulty signal is still observed, additional signal tracing/fault isolation will be necessary. Refer to the appropriate Circuit Description in **Section III** and appropriate Schematic Diagram in **Section VI**.

Table 4-5. AM/SSB/CW Demodulator (A1A2) Fault Isolation Table (IF Section)

Test Point	Normal Signal	Key Components	Comments
Q1-3	90 mv RMS	T1	
Q1-1	100 mv RMS 21.4 MHz (Reduce input to -80 dBm.)	Q1	Check voltage at Q1-2. Should be +4 Vdc. If not, check CR1 and AGC section.
U2-2	65 mv	U2, U14	
CR6 Anode	20 mV (NB) 5 mV (WB)	CR2-CR7, U3	Rotate BW switch through all BW positions. Set input level according to **Table 4-4a.**
E4	+0.5 Vdc Change as signal is switched on and off.	Q1, CR8	Use Oscilloscope. Adjust generator to achieve 0.5 Vdc change.
U6-10	260 mV		BFO Signal. Set Rcvr to CW Mode, -0.4 kHz BFO.
E4	0.5 V p-p	U1, CR8, Q1	Set Signal Generator for 50% AM modulation.
U4-6	0.5 V p-p	U4	Set Signal Generator for 50% AM modulation.
U6-12	0.6 V p-p 400 Hz	U6	Use Oscilloscope.
U7-1	0.6 V p-p 400 Hz	U7	Use Oscilloscope.

4.8.2.3 **AGC Test Setup Procedure**

The following test setup procedure should be performed prior to testing or troubleshooting the AM/SSB/CW Demodulator:

1. Perform the preliminary test setup procedure (see **paragraph 4.8**).

2. Connect the Signal Generator to the RF Input of the Receiver.

3. Set the Signal Generator as follows:

   a. RF Frequency 100 MHz
   b. Output Level -40 dBm
   c. Modulation None

4. Energize the Receiver and the IFD220. Use the Receiver controls to set up the following parameters:

   a. MAN/AGC MAN
   b. RF Gain Maximum
   c. DET MODE AM
   d. IF BW select narrowest IFD220 BW
   e. TUNED FREQ 100 MHz

5. Use an Oscilloscope to verify that a 0.5 V p-p signal is present at U4-6. Adjust the Signal Generator output level slightly as necessary to achieve the correct signal level.

4.8.2.4 **AGC Testing and Troubleshooting Procedure**

The testing and troubleshooting information contained in this paragraph is keyed to **Table 4-6**, AM/SSB/CW Demodulator (A1A2) Fault Isolation Table (AGC Section). This table is used to isolate the module fault to a defective stage or circuit. Perfrom the following procedures in the sequence given.

1. Us an oscilloscope to check each test point listed in **Table 4-6**.

2. When a faulty component is found refer to **paragraph 4.9**, Parts Replacement Guidlines for replacement of faulty PC Board Components.

3. Replacemnt of the indicated key component(s) will normally restore the faulty test point signal to a normal level. If a faulty signal is still observed, additional signal tracing/fault isolation will be necessary. Refer to the appropriate Circuit Description in **Section III** and appropriate Schematic Diagram in **Section VI**.

Table 4-6. AM/SSB/CW Demodulator (A1A2) Fault Isolation Table (AGC Section)

Condition	Test Point	Normal Signal	Comments
AGC ON	U4-6	0.5 VDC	Gen. Modulation Off.
AGC ON	U7-8	0 Vdc	As U4-6 = 0.5 Vdc U7-8 should be starting negative thru 0 Vdc.
AGC ON, Input Signal is 60 dB above level in Table 4-3.	U10-8 U10-14 U10-7 U7-7 U7-8	+4.5 Vdc -6 Vdc +5.4 Vdc +11.5 Vdc -4.4 Vdc	
Change gain cont. mode to MAN and set RF Gain control maximum CCW.	U10-8 U10-7 U10-14 U7-7	+5.6 Vdc +8 Vdc -6 Vdc 1.8 Vdc	
AGC ON, DET MODE set to SSB, Signal Generator = Table 4-3.	U7-14 U7-8	+0.5 Vdc	As U4-6 = 0.5 Vdc U7-8 should be starting negative thru 0 Vdc
AGC ON, DET MODE set to PULSE, Signal Generator = Table 4-3.	U7-14 U7-8	+0.5 Vdc 0 Vdc	As U4-6 = 0.5 Vdc U7-8 should be starting negative thru 0 Vdc.

4.8.3 VIDEO/AUDIO/COS (A1A3) TESTING AND TROUBLESHOOTING

A Signal Generator, an RF Voltmeter, and an Oscilloscope (see **Table 4-2**) are required to perform the tests outlined below.

4.8.3.1 Test Setup Procedure

The following test setup procedure should be performed prior to testing or troubleshooting the Video/Audio/COS (A1A3):

1. Perform the preliminary test setup procedure (see **paragraph 4.8.**
2. Conenct the Signal Generator to J4.
3. Set the Signal Generator as follows:

a.	RF Frequency	21.4 MHz
b.	Output Level	according to **Table 4-4a**
c.	Modulation	None

4. Energize the Receiver and the IFD220. Use the Receiver controls to set up the following parameters:

a.	MAN/AGC	MAN
b.	RF Gain	Maximum
c.	DET MODE	AM
d.	IF BW	Narrowest IFD220 Bandwidth

4.8.3.2 Testing and Troubleshooting Procedure

The testing and troubleshooting information contained in this paragraph is keyed to **Table 4-7**, Video/Audio/COS (A1A3) Fault Isolation Table. This table is used to isolate the module fault to a defective stage or circuit. Perfrom the following procedures in the sequence given.

1. Use an Oscilloscope to check each test point listed in **Table 4-7.**
2. When a faulty component is found refer to **paragraph 4.9,** Parts Replacement Guidlines for replacement of faulty PC Board Components.
3. Replacemnt of the indicated key component(s) will normally restore the faulty test point signal to a normal level. If a faulty signal is still observed, additional signal tracing/fault isolation will be necessary. Refer to the appropriate Circuit Description in **Section III** and appropriate Schematic Diagram in **Section VI.**

Table 4-7. Video/Audio/COS (A1A3) Fault Isolation Table

Condition	Test Point	Normal Signal	Key Components	Comments
Set Signal Generator for 50% AM, 1 kHz rate.	J2-1	0.25 Vpp		Adjust Signal Generator to obtain level.
	U2-6	2 Vpp	U2	
	U3-4	2 Vpp	U2	
	U5-8	2 Vpp		
	E4	7 Vpp		
	U4-1	11 Vpp		
Using front panel change squelch threshold to verify audio can be turned on and off at U7-15.	U7-15		U7	
	U7-16	+5/0 Vdc		
Change DET. MODE to FM, Set Signal Gen. to Freq. = to 21.4 MHz +0.5 x selected IF BW.	J2-4	0.5 Vdc		
	U1-6	-1.7 Vdc	U1	
	U3-4	-1.7 Vdc	U3	
	U5-8	-1.7 Vdc	U5	
	U4-7	+6 Vdc	U4	
Set Signal Gen. for no modulation with level = 30 dB above Table 4-2. Set Receiver DET. MODE to AM and Gain Mode to AGC.	U10-3	+1.7 Vdc		
	U6-10	+1.7 Vdc	U10	
	U6-8	+1.7 Vdc	U6	
	U6-14	-3.6 Vdc	U6	
	U6-7	+3.6 Vdc	U6	

4.8.4 DIGITAL INTERFACE (A1A4) TESTING AND TROUBLESHOOTING

An Oscilloscope (see **Table 4-2**) are required to perform the tests outlined below.

4.8.4.1 Test Setup Procedure

The following test setup procedure should be performed prior to testing or troubleshooting the Digital Interface (A1A4):

1. Perform the preliminary test setup procedure (see **paragraph 4.8**).

2. Energize the Receiver and IFD220. Using the Receiver set the following paramters:

a.

a.	MAN/AGC	MAN
b.	RF Gain	Maximum
c.	DET MODE	AM
d.	IF BW	Maximum available IFD220 Bandwidth

4.8.4.2 Testing and Troubleshooting Procedure

The testing and troubleshooting information contained in this paragraph is keyed to **Table 4-8, Table 4-9 amd Table 4-10**, Digital Interface (A1A4) Fault Isolation Tables. These tables are used to isolate the module fault to a defective stage or circuit. Perform the following procedures in the sequence given.

1. Using an Oscilloscope, verify the external input signals to the Microcontroller *U1) using TAble 4-8.

2. Use an Oscilloscope to verify microcontroll U1 data bus and control signal acivity using able 4-9

3. Using an Oscilloscope, verify I/O signal activity using **Table 4-10.**

4. Use the Oscilloscope to check the serial data input and output line of the serial interface circuit. See **Table 4-11.**

5. When a faulty component is found refer to **paragraph 4.9**, Parts Replacement Guidlines for replacement of faulty PC Board Components.

6. Replacement of the indicated key component(s) will normally restore the faulty test point signal to a normal level. If a faulty signal is still observed, additional signal tracing/fault isolation will be necessary. Refer to the appropriate Circuit Description in **Section III** and appropriate Schematic Diagram in **Section VI.**

Table 4-8. Microcontroller Input

Test Point	Normal Signal	Key Components	Comments
U1-12	Pulse Train 200 ms	U4, U21, U2	INT0
U1-13	Pulse Train 200 ms	U12	INT1
U1-18, 19	10 MHz Sine	Y1, U1	Clock Signal
U1-9	0 Vdc	U20	Reset Signal

Table 4-9. Microcontroller Bus Activity Check

Test Point	Normal Signal	Key Components	Comments
U1 Pin 32-29 (AD0-AD7)	Rapidly changing logic levels on each pin	U1	Observe irregular pulse trains
U1 pin 24-29 (A8-A11)	Rapidly changing logic levels on each pin	U1	
U1-16, 17 (U1-16, 17	Sharp, negative going pulses, 1 us	U1	
U1-29 (PSEN)	Square wave, 1 us	U1	
U1-30 (ALE)	Squre wave, 1 us	U1	

Table 4-10. Digital Interface (A1A4) I/O Signal Check

Test Point	Normal Signal	Key Components	Comments
U11 Q0-Q7 outputs	Rapidly changing logic levels	U11	Address Latch
U22 Y0-Y7 outputs	Sharp, negative going pulses	U22	Address Decoder
U3-2	Low	U3	
U3-5	Depends on BW	U3	
U3-6	Depends on BW	U3	
U3-9	Depends on BW	U3	
U3-12	High	U3	
U3-15	Pulse	U3	
U3-16	High	U3	
U3-19	High	U3	
U10-4	+2.5 Vdc	U19	D/A Reference
U10-2	+1 Vdc	U10	MAN Gain Volts
U10-1	0 Vdc	U10	COS THR Volts
U10-20	Depends on Freq.	U10	Tuning Volts
U1 pin 1-7, 14, 15	Pulses when tuning	U1	Syn Addr/Data

Table 4-11. Serial Interface Data Check

Test Point	Normal Signal	Key Components	Comments
U24-9	Sharp negative going pulse	U22, U23	
U12-9	Serial pulse train	U24, U12, U23	Report Data Out
U25-15	Sharp negative going pulse	U22, U23	
U25-2	Serial pulse train	U21	Command Data In

4.8.5 FM DEMODULATOR MOTHERBOARD (A1A5) TESTING AND TROUBLESHOOTING

A Signal Generator, an RF Voltmeter, and an Oscilloscope (see Table 4-2) are required to perform the tests outlined below.

4.8.5.1 Test Setup Procedure

The following test setup procedure should be performed prior to testing or troubleshooting the FM Motherboard (A1A5):

1. Perform the preliminary test setup procedure (see **paragraph 4.8.**
2. Connect the Signal Generator to J4.
3. Set the Signal Generator as follows:

   a. RF Frequency 21.4 MHz
   b. Output Level -60 dBm
   c. Modulation None

4. Energize the Receiver and the IFD220. Use the Receiver controls to set up the following parameters:

   a. MAN/AGC AGC
   b. RF Gain Maximum
   c. DET MODE AM
   d. IF BW Narrowest IFD220 Bandwidth

5. Using the RF Voltmeter Probe Tip, verify that a 20 mVrms signal is present at A1A5P4. Adjust the Signal Generator output level slightly as necessary to achieve the correct signal level.

4.8.5.2 **Testing and Troubleshooting Procedure**

The testing and troubleshooting information contained in this paragraph is keyed to **Table 4-12**, FM Demodulator Motherboard (A1A5) Fault Isolation Table, **Table 4-13**, FM Demodulator (10-25 kHz) Fault Isolation Table, **Table 4-14**, FM Demodulator (25-250 khz) Fault Isolation Table, and **Table 4-15**, FM Demodulator (250 kHz-4 MHz) Fault Isolation Table. These tables are used to isolate the module fault to a defective stage or circuit. Perfrom the following procedures in the sequence given.

1. Us an RF Voltmeter Probe Tip or Oscilloscope to check each test point listed in **Table 4-12.**

2. When a faulty component is found refer to **paragraph 4.9**, Parts Replacement Guidlines for replacement of faulty PC Board Components.

3. If **Table 4-12** indicates a faulty FM Demodulator Module(s) A1A5A1 through A1A5A4, the module fault may be confirmed by removing it and substituting one of the other three modules in its place. Once the module is confirmed as faulty, refer to either **Table 4-13, Table 4-14, or Table 4-15** as appropriate. Use the RF Voltmeter Probe Tip and an Oscilloscope to check each test point listed in the appropriate table. When a faulty signal is found on the FM Demodulator module, replace the key components indicated in the fault isolation table.

4. Replacement of the indicated key component(s) will normally restore the faulty test point signal to a normal level. If a faulty signal is still observed, additional signal tracing/fault isolation will be necessary. Refer to the appropriate Circuit Description in **Section III** and appropriate Schematic Diagram in **Section VI.**

Table 4-12. FM Demodulator Motherboard Fault Isolation Table

Test Point	Normal Signal	Key Components	Comments
A1P1-11	+15 V	U1, U2	Select BW#1
A1P2-1	-15 V	U1, U2	Select BW #1
A2P1-11	+15 V	U1, U2	Select BW #2
A2P2-1	-15 V	U1, U2	Select BW #2
A3P1-11	+15 V	U2, U3	Select BW #3
A3P2-1	-15 V	U2, U3	Select BW #3
A4P1-11	+15 V	U2, U3	Select BW #4
A4P2-1	-15 V	U2, U3	Select BW #4
U5-3	**0.6 Vpp (OR 0.3 Vdc) @ 400 Hz	A1-A4, U5	Select BWs #1 through #4. *FM Deviation = 1/3 IF BW, Frequency modulation = 400 Hz.
U6-6	0 Vdc	U6	No modulation
U6-6	+2.5 Vdc		Set dem = 0, Freq = 21.4 MHz +1/2 + IF BW.
U4-13	250 mVpp @ 400 Hz	U4	Select AM Mode. Set Generator for 50% AM @ 400 Hz. Select BW #1 through BW #4.
U2-3	Approx 100 mVdc (Gain Set)	U2, A-1-A4	Select BW #1 - BW #4

* If signal generator cannot be deviated by 1/3 the IF Bandwidth, set the Signal Generator to 21.4 MHz (no modulation) + 1/3 x selected IF Bandwidth.

** DC offset may be observed with the cover removed.

Table 4-13. FM Demodulator (10 - 25 kHz) Fault Isolation Table

Test Point	Normal Signal	Key Components	Comments
U1-5	700 mVrms @ 21.4 MHz	U1, VR1, VR2	
U2-14	1.2 Vpp @ 400 Hz	Y1, CR1, CR2, U2	FM Deviation = 1/3 IF BW

Table 4-14. FM Demodulator (25 - 250 kHz) Fault Isolation Table

Test Point	Normal Signal	Key Components	Comments
U1-5	1000 mVrms @ 21.4 MHz	U1, VR1, VR2	
U2-14	1.2 Vpp @ 400 Hz	CR1, CR2, U2	FM Deviation = 1/3 IF BW

Table 4-15. FM Demodulator (250 kHz - 4 MHz) Fault Isolation Table

Test Point	Normal Signal	Key Components	Comments
U1-5	700 mVrms	U1, VR1	
U2-6	600 mVpp	T1, CR1, CR2, U2	FM Deviation = 1/3 IF BW

4.9 PARTS REPLACEMENT GUIDELINES

This paragraph provides techniques to assist the technician in replacing components on PC boards.

WARNING

To prevent electrical shock or damage to the unit, always disconnect the receiver from the AC power source before soldering or replacing components.

4.9.1 SOLDERING TECHNIQUES

When removing components from a printed circuit board for inspection or replacement, be especially careful not to damage the track. The soldering iron power should be no higher than 40 watts, and a solder sipper or wicking procedure should be employed when removing solder. Noncorrosive solder flux should be used when removing solder by wicking. In returning components to the board, make sure that holes are clear and that leads do not catch the edge of the track and lift it from the board. A good grade of rosin core 60/40 solder should be used. Do not heat longer than is necessary to achieve a good joint. A heat sink should be used where possible.

4.9.2 COMPONENT REPLACEMENT

The following are specific guidelines for replacing the various kinds of components:

1. When soldering or unsoldering diodes or resistors, solder quickly to allow as little heat conduction as possible. When wiring permits, use a heat sink between the soldering iron and the part.

2. When soldering or unsoldering transistors, use a low wattage iron and a heat sink. Solder as quickly as possible. The use of a circular solder tip to heat all three joints simultaneously is recommended.

3. When soldering or unsoldering glass or ceramic capacitors, use a heat sink between the capacitor and the iron. Excessive heat will crack the capacitor body.

4. When any electronic part is removed, note the position of the part and its leads, and replace it the same way.

SECTION IV

REPLACEMENT PARTS LIST

5.1 UNIT NUMBERING METHOD

The unit numbering method of assigning reference designations (electrical symbol numbers) has been used to identify assemblies, subassemblies, (and modules) and parts. An example of the unit numbering method 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)

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

5.2 REFERENCE DESIGNATION PREFIX

Partial reference designations have been used on the equipment and on the illustrations in this manual. The partial reference designations consist of the class letter(s) and identifying item number. The complete reference designation may be obtained by placing the proper prefix before the partial reference designations. Reference Designation Prefixes are provided on drawings and illustrations in parentheses within the figure titles.

5.3 LIST OF MANUFACTURERS

Mfr. Code	Name and Address
00779	AMP, Incorporated P.O. Box 3608 Harrisburg, PA 17105
01295	Texas Instruments, Incorporated Semiconductor-Components Div. 15300 North Central Expressway Dallas, TX 75231
02735	RCA Corporation Solid State Division Somerville, NJ 08876
04013	Taurus Corporation 1 Academy Hill Lambertville, NJ 08530
04213	Caddell-Burns Mfg. Co., Inc. 40 E. Second Street Mineola, NY 11501
04713	Motorola, Incorporated Semiconductor Products Div. 5005 East McDowell Road Phoenix, AZ 85008

Mfr. Code	Name and Address
06090	Raychem Corporation 300 Constitution Drive Menlo Park, CA 94025-1111
06665	Precision Monolithics, Inc. 1500 Space Park Drive Santa Clara, CA 95050
06776	Robinson-Nugent, Incorporated 800 East 8th Street Albany, IN 47150
09021	Airco, Incorporated Airco Electronics Bradford, PA 17055
12498	Teledyne Crystalonics Division of Teledyne Ind., Inc. 147 Sherman Street Cambridge, MA 02140
14193	CAL-R, Incorporated 1601 Olympic Boulevard P.O. Box 1397 Santa Monica, CA 90404
14632	Watkins-Johnson Company 700 Quince Orchard Road Gaithersburg, MD 20878
15542	Mini-Circuits Laboratories Division of Scientific Components Corporation 2625 E. 14th Street Brooklyn, NY 11235
17856	Siliconix, Incorporated 2201 Laurelwood Road Santa Clara, CA 95050
18324	Signetics Corporation 811 East Arques Avenue Sunnyvale, CA 94086
19505	Applied Eng. Products, Company Division of Samarious, Inc. 300 Seymour Avenue Derby, CT 06418
22526	Du Pont El De Nemours and Co. Inc., Photo Products Department Berg Electronics Division, Rt. 83 New Cumberland, PA 17070
24355	Analog Devices, Incorporated Route 1 Industrial Park P.O. Box 280 Norwood, MA 02062
26805	MA-COM Omni Spectra, Inc. 140 Fourth Avenue Walton, MA 02154
27014	National Semi-Conductor Corp. 2950 San Ysidro Way Santa Clara, CA 95051
27956	Relcom 3333 Hillview Avenue Palo Alto, CA 94304
28480	Hewlett-Packard Company Corporate Headquarters 1501 Page Mill Road Palo Alto, CA 94304
33095	Spectrum Control, Incorporated 152 East Main Street Fairview, PA 16415

Mfr. Code	Name and Address
34371	Harris Corporation Harris Semiconductor Products Group 200 Palm Bay Boulevard P.O. Box 883 Melbourne, FL 32919
34649	Intel Corporation 3065 Bowers Avenue Santa Clara, CA 95051
51642	Centre Engineering, Incorporated 2820 East College Avenue State College, PA 16801-7515
52648	Plessey Trading Corporation Plessey Optoelectronics and Microwave 1641 Kaiser Avenue Irvine, CA 92714
54473	Matsushita Electric Corporation One Panasonic Way P.O. Box 1501 Secaucus, NJ 07094
55322	Samtec, Incorporated 810 Progress Boulevard P.O. Box 1147 New Albany, IN 478150
56289	Sprague Electric Company Marshall Street North Adams, MA 01247
59660	Tusonix, Incorporated 2155 North Forbes Boulevard Tucson, AZ 85745
71279	Cambridge Thermionic Corp. 445 Concord Avenue Cambridge, MA 02138
71468	ITT Cannon Electric Division of ITT Corporation 10550 Talbert Avenue P.O. Box 8040 Fountain Valley, CA 92708
72982	Murata Erie North America, Inc. 645 West 11th Street Erie, PA 16512
73138	Beckman Instruments, Inc. Helipot Division 2500 Harbor Boulevard Fullerton, CA 92634
80131	Electronic Industries Association 2001 Eye Street, N.W. Washington, DC 20006
81312	Winchester Electronics Division of Litton Systems, Inc. 400 Park Road Watertown, CT 06795-1612
81349	Military Specifications
95121	Quality Components, Inc. P.O. Box 1348 North Andover, MA 01842
95146	Alco Electronic Products, Inc. P.O. Box 1348 North Andover, MA 01842
98291	Sealectro Corporation 40 Lindeman Drive Trumbull, CT 06611

Mfr. Code	Name and Address
99800	American Precision Industries Delevan Electronics Division 270 Quaker Road East Aurora, NY 14052-2114

5.4 PARTS LIST

The parts list which follows contains all electrical parts used in the equipment and certain mechanical parts which are subject to unusual wear or damage. When ordering replacement parts from Watkins-Johnson Company, specify the type and serial number. of the equipment and the reference designation and description of each part ordered. The list of manufacturers provided in **paragraph 5.3**, and the manufacturer's part number for components are included as a guide to the user of the equipment in the field. These parts may not necessarily agree with the parts installed in the equipment; however, the parts specified in this list will provide satisfactory operation of the equipment. Replacement parts may be obtained from any manufacturer as long as the physical and electrical parameters of the part selected agree with the original indicated part. In the case of components 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 semi-conductors 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 semi-conductors designated in the manual may be substituted in every case with satisfactory results.

5.5 TYPE WJ-9040 IFD220 IF DEMODULATOR, MAIN CHASSIS

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
A1	21.4 MHz IF Demodulator	1	794582-2	14632	
A2	LED Flexible Board	1	271134-3	14632	

5.5.1 TYPE 794582-2 21.4 MHz IF DEMODULATOR

REF DESIG PREFIX A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
A1	21.4 MHz Bandpass Amplifier	1	371150-2	14632	
A2	AM/SSB/CW Demodulator	1	371575-1	14632	
A3	Video/Audio/COS	1	371571-1	14632	
A4	Digital Interface	1	371665-1	14632	
A5	FM Demodulator Motherboard	1	371249-1	14632	
C1	Capacitor, Ceramic, Feedthru: 100 pF, GMV 50 V	2	SCI9900-101	33095	
C2	Same as C1				
E1	Terminal, Feedthru, Insulated	5	SFU16Y	04013	
E2 Thru E5	Same as E1				
J1	Connector, Receptacle	1	DBSFY-25P	71468	
J2	Connector, Receptacle	1	499177-4	00779	
J3	Connector, Receptacle: SMA	1	9412-7113-000	19505	
J4	Connector, Jack: SMA	1	2004-7885-00	26805	
J5	Connector, Receptacle	1	SRE9SJ	81312	
R1	Resistor, Fixed, Film: 100Ω, 5%, 1/4 W	1	CF1/4-100 OHMS/J	09021	
W1	Cable Assembly	1	271421-1	14632	
W2	Cable Assembly	1	271673-1	14632	
W3	Cable Assembly	1	371213-6	14632	
W4	Cable Assembly	1	371213-7	14632	
W5	Cable Assembly	1	371213-12	14632	
W6	Cable Assembly	1	371213-9	14632	
W7	Cable Assembly	1	371213-13	14632	
W1P1	Connector, Plug	1	IDD-13-G	55322	
W2P1	Connector, Plug	1	IDD-10-G	55322	
W3P1	Connector, Plug	2	IDS-9-G	55322	
W3P2	Same as W3P1				
W4P1	Connector, Strip	4	IDS-6-G	55322	
W4P2	Same as W4P1				
W5P1	Connector, Plug	2	IDS-16-G	55322	
W5P2	Same as W5P1				
W6P1	Connector, Plug	2	IDD-5-G	55322	
W6P2	Same as W6P1				
W7P1	Same as W4P1				
W7P2	Same as W4P1				

5.5.1.1 **Type 371150-2 21.4 MHz Bandpass Amplifier** REF DESIG PREFIX A1A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C1	Capacitor, Ceramic, Disc: 4700 pF, 10%, 50 V	35	8111-050-X7RO-472K	59660	
C2	Same as C1				
C3	Capacitor, Ceramic, Disc: 3.3 pF, ±.25 pF, 100 V	1	8101-100-COJO-339C	59660	
C4	Same as C1				
C5	Capacitor, Ceramic, Monolithic: 470 pF, 5%, 100 V	1	8121-100-COGO-470J	59660	
C6	Same as C1				
C7	Capacitor, Ceramic, Disc: 0.1 µF, 10%, 100 V	1	8121-100-X7RO-104K	59660	
C8	Capacitor, Ceramic, Disc: 0.47µF, 20%, 50 V	5	34452-1	14632	
C9	Capacitor, Ceramic, Disc: 0.1µF, 20%, 50 V	1	8121-050-651-104M	59660	
C10	Same as C8				
C11	Same as C8				
C12 Thru C18	Same as C1				
C19	Same as C8				
C20	Same as C1				
C21	Same as C8				
C22 Thru C24	Same as C1				
C25	Not Used				
C26 Thru C44	Same as C1				
CR1	Diode	12	5082-3188	28480	
CR2 Thru CR12	Same as CR1				
CR13	Diode	1	1N4449	80131	
E1	Terminal, Forked	2	140-1941-02-01	71279	
E2	Same as E1				
FL1	Filter		Customer Option		
FL2 Thru FL4	Same as FL1				
J1	Terminal, Strip	1	65500-106	22526	
L1	Coil, Fixed, Molded: 8.2 µH	1	1025-42	99800	
L2	Connector, Variable: 4.7 mH	1	6740-21	04213	
L3	Coil, Fixed: 3.9 µH	3	1025-34	99800	
L4	Coil, Fixed: 18 µH	4	1025-50	99800	
L5	Same as L4				
L6	Same as L3				
L7	Same as L4				
L8	Same as L3				

REF DESIG PREFIX A1A1

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
L9	Same as L4				
P1	Pin Socket	1	NS-441-B1	06776	
Q1	Transistor	1	CP643	12498	
Q2	Transistor	1	2N2222A	80131	
R1	Resistor, Fixed, Film: 47Ω, 5%, 1/8 W	2	CF1/8-47 OHMS/J	09021	
R2	Resistor, Fixed, Film: 470Ω, 5%, 1/8 W	2	CF1/8-470 OHMS/J	09021	
R3	Resistor, Fixed, Film: 6.8 kΩ, 5%, 1/8 W	5	CF1/8-6.8K/J	09021	
R4	Resistor, Fixed, Film: 1.2 kΩ, 5%, 1/8 W	1	CF1/8-1.2K/J	09021	
R5	Same as R2				
R6	Resistor, Fixed, Film: 2.2 kΩ, 5%, 1/8 W	1	CF1/8-2.2K/J	09021	
R7	Resistor, Fixed, Film: 1.5 kΩ, 5%, 1/8 W	5	CF1/8-1.5K/J	09021	
R8	Resistor, Fixed, Film: 39Ω, 5%, 1/8 W	4	CF1/8-39 OHMS/J	09021	
R9	Resistor, Fixed, Film: 18 kΩ, 5%, 1/8 W	4	CF1/8-18K/J	09021	
R10	Same as R3				
R11	Same as R1				
R12	Resistor, Fixed, Film: 160Ω, 5%, 1/8 W	1	CF1/8-160 OHMS/J	09021	
R13	Not Used				
R14	Resistor, Fixed, Film: 680Ω, 5%, 1/8 W	1	CF1/8-680 OHMS/J	09021	
R15	Same as R7				
R16	Same as R8				
R17	Same as R9				
R18	Same as R3				
R19	Same as R7				
R20	Same as R8				
R21	Same as R9				
R22	Same as R3				
R23	Same as R7				
R24	Same as R7				
R25	Same as R8				
R26	Same as R9				
R27	Same as R3				
U1	Attenuator	1	G1	27956	
U2	Integrated Circuit	1	MC14052BCP	04713	
U3	Voltage Regulator	1	MC78L15ACP	04713	
U4	Integrated Circuit	1	SL550D/DG	52648	
U5	Integrated Circuit	1	LM317LZ	27014	
U6	Voltage Regulator	1	MC79L15ACP	04713	

5.5.1.2 **Type 371575-1 AM/SSB/CW Demodulator** REF DESIG PREFIX A1A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C1	Capacitor, Ceramic, Disc: 4700 pF, 10%, 50 V	37	8111-050-X7RO-472K	59660	
C2 Thru C7	Same as C1				
C8	Capacitor, Ceramic, Disc: 0.47 µF, 20%, 50 V	10	34452-1	14632	
C9	Same as C8				
C10	Same as C1				
C11	Same as C1				
C12	Capacitor, Electrolytic, Aluminum: 0.47 µF, ±20%, 16 V	1	ECE-A1CK470	54473	
C13	Same as C1				
C14	Same as C1				
C15	Capacitor, Ceramic, Disc: 680 pF, 5%, 100 V	1	8121-100-COGO-681J	59660	
C16	Same as C1				
C17	Same as C8				
C18 Thru C21	Same as C1				
C22	Capacitor, Variable, Ceramic: 5-25 pF, 100 V	2	518-000A5-25	59660	
C23	Capacitor, Ceramic, Disc: 560 pF, 5%, 100 V	2	8121-100-COGO-560J	59660	
C24	Capacitor, Ceramic, Disc: 750 pF, 5%, 50 V	1	8121-050-COGO-751J	59660	
C25	Capacitor, Composition, Tubular: 1.0 pF, 10%, 500 V	1	QC1.OPFK	95121	
C26	Same as C22				
C27	Same as C23				
C28	Capacitor, Ceramic, Disc: 390 pF, 5%, 100 V	1	8121-100-COGO-391J	59660	
C29 Thru C32	Same as C1				
C33	Capacitor, Variable, Ceramic: 1-3 pF, 100 V	1	518-000A1-3	59660	
C34	Same as C1				
C35	Capacitor, Ceramic, Disc: 3.9 pF, ±0.25 pF, 100 V	1	8101-100-COJO-399C	59660	
C36	Capacitor, Ceramic, Monolithic: 10 pF, ±0.5 pF, 100 V	1	8101-100-COGO-100D	59660	
C37	Same as C8				
C38	Same as C8				
C39	Capacitor, Ceramic, Disc: 100 pF, 5%, 100 V	1	8121-100-COGO-101J	59660	
C40	Capacitor, Ceramic, Disc: 1000 pF, 5%, 50 V	1	8121-050-COGO-102J	59660	
C41	Capacitor, Ceramic, Disc: 1 µF, 20%, 50 V	3	8131-050-651-105M	59660	
C42	Capacitor, Electrolytic, Tantalum: 15 µF, 10%, 25 V	1	ECS-F1EE156K	00000	
C43 Thru C48	Same as C1				
C49	Capacitor, Ceramic, Disc: 0.01 µF, 20%, 50 V	2	8121-050-651-103M	59660	
C50 Thru C53	Same as C8				
C54	Capacitor, Ceramic, Disc: 0.1 µF, 20%, 50 V	4	8121-050-651-104M	59660	

REF DESIG PREFIX A1A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C55 Thru C58	Same as C8				
C59 Thru C61	Same as C54				
C62	Capacitor, Ceramic, Monolithic: 110 pF, ±2%, 100 V	1	200-100-NPO-111G	51642	
C63	Same as C1				
C64	Capacitor, Ceramic, Disc: 18 pF, 5%, 100 V	2	8111-100-COGO-180J	59660	
C65	Capacitor, Ceramic, Disc: 150 pF, ±5%, 100 V	2	200-100-NPO-151J	51642	
C66	Capacitor, Ceramic, Monolithic: 75 pF, ±2%, 100 V	1	200-100-NPO-750G	51642	
C67	Same as C8				
C68	Same as C1				
C69	Same as C12				
C70	Same as C41				
C71	Same as C41				
C72	Capacitor, Ceramic, Disc: 3.3 µF, 20%, 25 V	1	8141-050-651-335M	59660	
C73	Capacitor, Ceramic, Monolithic: 10 pF, ±0.5 pF, 100 V	1	8101-100-COGO-100D	59660	
C74 Thru C79	Same as C1				
C80	Same as C49				
C81	Same as C1				
C82	Same as C1				
C83	Same as C64				
C84	Capacitor, Ceramic, Monolithic: 180 pF, ±2%, 100 V	1	150-100-NPO-181G	51642	
C85	Same as C64				
C86	Capacitor, Ceramic, Monolithic: 220 pF, ±2%, 100 V	1	150-100-NPO-221G	51642	
CR1	Diode	6	1N4446	80131	
CR2	Diode	6	5082-3188	28480	
CR3 Thru CR7	Same as CR2				
CR8	Diode	1	5082-2800	28480	
CR9	Same as CR1				
CR10	Same as CR1				
CR11	Not Used				
CR12	Same as CR1				
CR13	Same as CR1				
CR14	Not Used				
CR15	Same as CR1				
E1	Terminal, Forked	3	140-1941-02-01	71279	
E2	Same as E1				
E3	Terminator, Coaxial	1	D-607-10	06090	

REF DESIG PREFIX A1A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
E4	Same as E1				
J1	Terminal, Strip	2	65500-106	22526	
J2	Connector, Receptacle	1	65500-116	22526	
J3	Same as J1				
J4	Connector, Jack: SMA	1	9030-9023-005	19505	
L1	Coil, Fixed, Molded: 0.22 µH	1	1025-04	99800	
L2	Coil, Fixed: 18 µH	5	1025-50	99800	
L3	Coil, Fixed: 2.2 µH	1	1025-28	99800	
L4	Same as L2				
L5	Same as L2				
L6	Coil, Mounted	2	271423-19	14632	
L7	Same as L6				
L8	Coil, Fixed: 62 µH	1	1537-66	99800	
L9	Same as L2				
L10	Coil, Fixed, Molded: 1.5 µH	1	1025-24	99800	
L11	Coil, Fixed, Molded: 0.33 µH	2	1025-08	99800	
L12	Same as L11				
L13	Coil, Fixed: 8.2 µH	1	1537-34	99800	
L14	Same as L2				
P1	Pin Socket	4	NS-441-B1	06776	
P2 Thru P4	Same as P1				
Q1	Transistor	2	MRF966	80131	
Q2	Transistor	1	2N2857	80131	
Q3	Transistor	1	2N3251	80131	
Q4	Transistor	2	2N2222A	80131	
Q5	Transistor	1	2N3251	80131	
Q6	Same as Q4				
Q7	Same as Q1				
R1	Resistor, Fixed, Film: 100 kΩ, 5%, 1/8 W	6	CF1/8-100K/J	09021	
R2	Resistor, Fixed, Film: 30 kΩ, 5%, 1/8 W	2	CF1/8-30K/J	09021	
R3	Resistor, Fixed, Film: 4.3 kΩ, 5%, 1/8 W	1	CF1/8-4.3K/J	09021	
R4	Resistor, Fixed, Film: 20 kΩ, 5%, 1/8 W	2	CF1/8-20K/J	09021	
R5	Resistor, Variable, Film: 5 kΩ, 10%, 1/2 W	1	62PAR5K	73138	
R6	Same as R2				
R7	Resistor, Fixed, Film: 150Ω, 5%, 1/8 W	1	CF1/8-150 OHMS/J	09021	
R8	Resistor, Fixed, Film: 330Ω, 5%, 1/8 W	3	CF1/8-330 OHMS/J	09021	
R9	Resistor, Fixed, Film: 820Ω, 5%, 1/8 W	3	CF1/8-820 OHMS/J	09021	
R10	Resistor, Fixed, Film: 100Ω, 5%, 1/8 W	7	CF1/8-100 OHMS/J	09021	
R11	Resistor, Fixed, Film: 220Ω, 5%, 1/8 W	3	CF1/8-220 OHMS/J	09021	
R12	Resistor, Fixed, Film: 180Ω, 5%, 1/8 W		CF1/8-180 OHMS/J	09021	

REF DESIG PREFIX A1A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R13	Resistor, Fixed, Film: 1.5 kΩ, 5%, 1/8 W	3	CF1/8-1.5K/J	09021	
R14	Resistor, Fixed, Film: 680Ω, 5%, 1/8 W	2	CF1/8-680 OHMS/J	09021	
R15	Same as R14				
R16	Same as R13				
R17	Resistor, Fixed, Film: 22Ω, 5%, 1/8 W	2	CF1/8-22 OHMS/J	09021	
R18	Same as R13				
R19	Resistor, Fixed, Film: 2.2 kΩ, 5%, 1/8 W	5	CF1/8-2.2K/J	09021	
R20	Resistor, Fixed, Film: 18 kΩ, 5%, 1/8 W	3	CF1/8-18K/J	09021	
R21	Same as R19				
R22	Same as R20				
R23	Resistor, Fixed, Film: 3.9 kΩ, 5%, 1/8 W	1	CF1/8-3.9K/J	09021	
R24	Resistor, Fixed, Film: 4.7 kΩ, 5%, 1/8 W	7	CF1/8-4.7K/J	09021	
R25	Same as R10				
R26	Same as R24				
R27	Resistor, Fixed, Film: 330Ω, 5%, 1/4 W	1	CF1/4-330 OHMS/J	09021	
R28	Resistor, Fixed, Film: 120Ω, 5%, 1/8 W	2	CF1/8-120 OHMS/J	09021	
R29	Resistor, Fixed, Film: 200 kΩ, 5%, 1/8 W	1	CF1/8-200K/J	09021	
R30	Resistor, Fixed, Film: 8.2 kΩ, 5%, 1/8 W	2	CF1/8-8.2K/J	09021	
R31	Same as R30				
R32	Resistor, Fixed, Film: 1.2 kΩ, 5%, 1/8 W	3	CF1/8-1.2K/J	09021	
R33	Resistor, Fixed, Film: 2.7Ω, 5%, 1/8 W	2	CF1/8-2.7 OHMS/J	09021	
R34	Resistor, Variable, Film: 500 kΩ, 10%, 1/2 W	1	62PR500K	73138	
R35	Resistor, Fixed, Film: 1.0 kΩ, 5%, 1/8 W	3	CF1/8-1.0K/J	09021	
R36	Resistor, Fixed, Film: 10 kΩ, 5%, 1/8 W	6	CF1/8-10K/J	09021	
R37	Same as R10				
R38	Resistor, Fixed, Film: 3.3Ω, 5%, 1/8 W	1	CF1/8-3.3 OHMS/J	09021	
R39	Same as R1				
R40	Resistor, Fixed, Film: 47 kΩ, 5%, 1/8 W	5	CF1/8-47K/J	09021	
R41	Resistor, Fixed, Film: 56Ω, 5%, 1/8 W	1	CF1/8-56 OHMS/J	09021	
R42	Resistor, Variable, Film: 20 kΩ, 10%, 1/2 W	1	62PR20K	73138	
R43	Resistor, Variable, Film: 3.6 kΩ, 5%, 1/8 W	1	CF1/8-3.6K/J	09021	
R44	Same as R17				
R45	Resistor, Variable, Film: 50Ω, 10%, 1/2 W	1	62PR50	73138	
R46	Same as R28				
R47	Resistor, Fixed, Film: 360Ω, 5%, 1/8 W	2	CF1/8-360 OHMS/J	09021	
R48	Resistor, Variable, Film: 500Ω, 10%, 1/2 W	1	62PR500	73138	
R49	Same as R19				
R50	Same as R19				
R51	Same as R32				
R52	Same as R35				
R53	Resistor, Variable, Film: 470Ω, 5%, 1/8 W	2	CF1/8-470 OHMS/J	09021	
R54	Resistor, Variable, Film: 12 kΩ, 5%, 1/8 W	1	CF1/8-12K/J	09021	

REF DESIG PREFIX A1A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R55	Same as R1				
R56	Resistor, Fixed, Film: 3.3 kΩ, 5%, 1/8 W	3	CF1/8-3.3K/J	09021	
R57	Same as R56				
R58	Resistor, Fixed, Film: 1.5 kΩ, 5%, 1/8 W	2	CF1/8-1.5K/J	09021	
R59	Same as R33				
R60	Resistor, Fixed, Film: 20Ω, 5%, 1/8 W	1	CF1/8-20 OHMS/J	09021	
R61	Same as R58				
R62	Same as R20				
R63	Resistor, Fixed, Film: 27 kΩ, 5%, 1/8 W	2	CF1/8-27K/J	09021	
R64	Resistor, Fixed, Film: 91 kΩ, 5%, 1/8 W	1	CF1/8-91K/J	09021	
R65	Same as R24				
R66	Same as R40				
R67	Same as R63				
R68	Same as R36				
R69	Resistor, Fixed, Film: 43 kΩ, 5%, 1/8 W	1	CF1/8-43K/J	09021	
R70	Resistor, Fixed, Film: 1.0MΩ, 5%, 1/8 W	1	CF1/8-1M/J	09021	
R71	Same as R40				
R72	Resistor, Fixed, Film: 2.7 kΩ, 5%, 1/8 W	2	CF1/8-2.7K/J	09021	
R73	Resistor, Variable, Film: 5 kΩ, 10%, 1/2 W	1	62PR5K	73138	
R74	Same as R1				
R75	Resistor, Fixed, Film: 2 kΩ, 5%, 1/8 W	2	CF1/8-2K/J	09021	
R76	Same as R36				
R77	Same as R36				
R78	Resistor, Fixed, Film: 33 kΩ, 5%, 1/8 W	1	CF1/8-33K/J	09021	
R79	Same as R36				
R80	Same as R24				
R81	Same as R36				
R82	Same as R24				
R83	Same as R56				
R84	Resistor, Fixed, Film: 23.7 kΩ, 1%, 1/10 W	1	RN55C2372F	81349	
R85	Resistor, Fixed, Film: 8.06 kΩ, 1%, 1/10 W	1	RN55C8061F	81349	
R86	Same as R35				
R87	Same as R75				
R88	Resistor, Fixed, Film: 2.21 kΩ, 1%, 1/10 W	1	RN55C2211F	81349	
R89	Resistor, Fixed, Film: 6.81 kΩ, 1%, 1/10 W	1	RN55C6811F	81349	
R90	Resistor, Fixed, Film: 20 kΩ, 1%, 1/10 W	1	RN55C2002F	81349	
R91	Resistor, Fixed, Film: 10 kΩ, 1%, 1/10 W	1	RN55C1002F	81349	
R92	Same as R40				
R93	Same as R10				
R94	Same as R8				
R95	Same as R24				
R96	Resistor, Fixed, Film: 330 kΩ, 5%, 1/8 W	1	CF1/8-330K/J	09021	

REF DESIG PREFIX A1A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R97	Same as R9				
R98	Same as R53				
R99	Same as R19				
R100	Same as R72				
R101	Resistor, Fixed, Composition: 10MΩ, 5%, 1/8 W	1	RCR05G106JS	81349	
R102	Same as R32				
R103	Resistor, Fixed, Film: 220 kΩ, 5%, 1/8 W	1	CF1/8-220K/J	09021	
R104	Same as R8				
R105	Resistor, Variable, Film: 20 kΩ, 10%, 1/2 W	1	62PR20K	73138	
R106	Same as R24				
R107	Same as R1				
R108	Same as R10				
R109	Same as R9				
R110	Same as R11				
R111	Same as R11				
R112	Resistor, Fixed, Film: 910Ω, 5%, 1/8 W	1	CF1/8-910 OHMS/J	09021	
R113	Resistor, Fixed, Film: 16 kΩ, 5%, 1/8 W	1	CF1/8-16K/J	09021	
R114	Same as R40				
R115	Same as R1				
R116	Same as R10				
R117	Same as R47				
R118	Same as R40				
R119	Same as R4				
R120	Same as R35				
RT1	Thermistor	1	1B102	14193	
T1	Transformer Assembly	1	271423-20	14632	
T2	Transformer, RF	3	T16-1	15542	
T3	Same as T2				
T4	Same as T2				
U1	Integrated Circuit	1	TDA1576N	52648	
U2	Integrated Circuit	3	MWA110	04713	
U3	Integrated Circuit	1	DG303ACJ	17856	
U4	Integrated Circuit	1	LH0032CG	27014	
U5	Same as U2				
U6	Integrated Circuit	1	MC1496P	04713	
U7	Integrated Circuit	2	NE5514N	18324	
U8	Integrated Circuit	1	SW06 GP	06665	
U9	Integrated Circuit	2	DG212CJ	17856	
U10	Same as U7				
U11	Same as U3				
U12	Voltage Regulator	1	MC79L15ACP	04713	
U13	Voltage Regulator	1	MC79L15ACP	04713	

REF DESIG PREFIX A1A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
U14	Integrated Circuit	1	LM317LZ	27014	
U15	Voltage Regulator	1	MC78L08ACP	04713	
U16	Same as U9				
U17	Same as U2				
W1	Cable Assembly	1	17300-353-1	14632	

5.5.1.3 Type 371571-1 Video/Audio/Cos REF DESIG PREFIX A1A3

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C1	Capacitor, Ceramic, Disc: 0.1 µF, 20%, 50 V	4	34475-1	14632	
C2	Same as C1				
C3	Capacitor, Ceramic, Disc: 390 pF, 5%, 100 V	3	8121-100-COGO-391J	59660	
C4	Capacitor, Ceramic, Disc: 0.1 µF, 20%, 50 V	8	8121-050-651-104M	59660	
C5	Capacitor, Ceramic, Monolithic: 240 pF, ±2%, 100 V	1	150-100-NPO-241G	51642	
C6	Same as C4				
C7	Same as C1				
C8	Same as C1				
C9	Capacitor, Ceramic, Disc: 2.2 µF, 10%, 50 V	1	8141-050-651-225M	59660	
C10	Capacitor, Ceramic, Disc: 0.47 µF, 20%, 50 V	8	34452-1	14632	
C11	Same as C3				
C12	Same as C4				
C13	Same as C4				
C14	Same as C3				
C15	Same as C10				
C16	Capacitor, Ceramic, Disc: 27 pF, 5%, 50 V	1	8111-050-COGO-270J	59660	
C17	Capacitor, Ceramic, Disc: 1 µF, 20%, 50 V	2	8131-050-651-105M	59660	
C18	Same as C17				
C19	Capacitor, Ceramic, Disc: 0.015 µF, 10%, 100 V	1	8121-100-X7RO-153K	59660	
C20	Same as C4				
C21	Same as C4				
C22 Thru C26	Same as C10				
C27	Same as C4				
C28	Same as C10				
C29	Capacitor, Electrolytic, Aluminum: 10 µF, ±20%, 25 V	2	ECE-A1EK100	54473	
C30	Same as C29				
C31	Same as C4				
CR1	Diode	5	1N4446	80131	
CR2 Thru CR5	Same as CR1				
E1	Terminal, Forked	9	140-1941-02-01	71279	
E2 Thru E9	Same as E1				
J1	Terminal, Strip	1	65500-109	22526	
J2	Terminal, Strip	1	65500-106	22526	
L1	Coil, Fixed: 120 µH, 10%	3	1025-70	99800	
L2	Coil, Fixed, Molded: 1.5 µH	1	1025-24	99800	
L3	Same as L1				
L4	Same as L1				

REF DESIG PREFIX A1A3

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
Q1	Transistor	1	2N2222A	80131	
R1	Resistor, Fixed, Film: 330Ω, 5%, 1/8 W	2	CF1/8-330 OHMS/J	09021	
R2	Resistor, Fixed, Film: 2.7Ω, 5%, 1/8 W	1	CF1/8-2.7 OHMS/J	09021	
R3	Resistor, Variable, Film: 2 kΩ, 10%, 1/2 W	1	62PR2K	73138	
R4	Resistor, Fixed, Film: 470Ω, 5%, 1/8 W	2	CF1/8-470 OHMS/J	09021	
R5	Resistor, Fixed, Film: 4.7 kΩ, 5%, 1/8 W	1	CF1/8-4.7K/J	09021	
R6	Resistor, Fixed, Film: 3.6 kΩ, 5%, 1/8 W	1	CF1/8-3.6K/J	09021	
R7	Resistor, Fixed, Film: 18 kΩ, 5%, 1/8 W	1	CF1/8-18K/J	09021	
R8	Resistor, Fixed, Film: 560Ω, 5%, 1/8 W	3	CF1/8-560 OHMS/J	09021	
R9	Same as R1				
R10	Resistor, Fixed, Film: 1.8 kΩ, 5%, 1/8 W	1	CF1/8-1.8K/J	09021	
R11	Resistor, Fixed, Film: 5 kΩ, 10%, 1/2 W	1	62PR5K	73138	
R12	Same as R4				
R13	Resistor, Fixed, Film: 1.0 kΩ, 5%, 1/8 W	3	CF1/8-1.0K/J	09021	
R14	Resistor, Fixed, Film: 68Ω, 5%, 1/8 W	1	CF1/8-68 OHMS/J	09021	
R15	Resistor, Fixed, Film: 10 kΩ, 5%, 1/8 W	5	CF1/8-10K/J	09021	
R16	Resistor, Fixed, Film: 56 kΩ, 5%, 1/8 W	1	CF1/8-56K/J	09021	
R17	Resistor, Fixed, Film: 8.2 kΩ, 5%, 1/8 W	2	CF1/8-8.2K/J	09021	
R18	Same as R8				
R19	Same as R15				
R20	Resistor, Fixed, Film: 36 kΩ, 5%, 1/8 W	1	CF1/8-36K/J	09021	
R21	Same as R17				
R22	Same as R8				
R23	Resistor, Fixed, Film: 2.2 kΩ, 5%, 1/8 W	2	CF1/8-2.2K/J	09021	
R24	Same as R15				
R25	Resistor, Fixed, Film: 680 kΩ, 5%, 1/4 W	1	CF1/4-680K/J	09021	
R26	Same as R23				
R27	Resistor, Fixed, Film: 100Ω, 5%, 1/8 W	3	CF1/8-100 OHMS/J	09021	
R28	Same as R15				
R29	Resistor, Fixed, Film: 10MΩ, 5%, 1/4 W	1	CF1/4-10M/J	09021	
R30	Resistor, Fixed, Film: 270Ω, 5%, 1/8 W	1	CF1/8-270 OHMS/J	09021	
R31	Resistor, Fixed, Film: 4.7 kΩ, 5%, 1/8 W	7	CF1/8-4.7K/J	09021	
R32	Resistor, Fixed, Film: 13 kΩ, 5%, 1/8 W	1	CF1/8-13K/J	09021	
R33	Resistor, Fixed, Film: 2.7 kΩ, 5%, 1/8 W	2	CF1/8-2.7K/J	09021	
R34	Same as R31				
R35	Resistor, Fixed, Film: 2.4 kΩ, 5%, 1/8 W	1	CF1/8-2.4K/J	09021	
R36	Same as R15				
R37	Same as R27				
R38	Same as R31				
R39	Same as R31				
R40	Resistor, Fixed, Film: 51 kΩ, 5%, 1/8 W	1	CF1/8-51K/J	09021	

REF DESIG PREFIX A1A3

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R41 Thru R43	Same as R31				
R44	Resistor, Fixed, Film: 5.6 kΩ,5%, 1/8 W	1	CF1/8-5.6K/J	09021	
R45	Same as R33				
R46	Same as R13				
R47	Same as R13				
R48	Same as R27				
U1	Integrated Circuit	2	HA2-5160-5	34371	
U2	Same as U1				
U3	Integrated Circuit	1	SW06 GP	06665	
U4	Integrated Circuit	2	NE5514N	18324	
U5	Integrated Circuit	1	LH0002CN	27014	
U6	Same as U4				
U7	Integrated Circuit	1	DG212CJ	17856	
U8	Voltage Regulator	1	MC79L15ACP	04713	
U9	Voltage Regulator	1	MC78L15ACP	04713	
U10	Integrated Circuit	1	LM318N	27014	
VR1	Diode	1	1N752A	80131	

5.5.1.4 **Type 371665-1 Digital Interface** REF DESIG PREFIX A1A4

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
C1	Capacitor, Electrolytic, Tantalum: 15 µF, 20%, 50 V	3	196D156X0015JE3	14632	
C2	Same as C1				
C3	Capacitor, Ceramic, Disc: 0.1 µF, 20%, 50 V	11	34475-1	14632	
C4 Thru C7	Same as C3				
C8	Capacitor, Ceramic, Disc: 0.47 µF, 20%, 50 V	6	34452-1	14632	
C9 Thru C11	Same as C8				
C12	Capacitor, Ceramic, Disc: 33 pF, 5%, 100 V	2	8121-100-COGO-330J	59660	
C13	Same as C12				
C14	Same as C3				
C15	Same as C8				
C16	Same as C8				
C17 Thru C21	Same as C3				
C22	Same as C1				
CR1	Diode	1	1N4003	80131	
E1	Terminal, Forked	9	140-1941-02-01	71279	
E2 Thru E9	Same as E1				
J1	Terminal, Strip	1	65610-126	22526	
J2	Terminal, Strip	1	65500-109	22526	
J3	Connector, Receptacle	1	65500 -116	22526	
J4	Terminal, Strip	1	65610-110	22526	
J5	Connector, Receptacle	1	65610-120	22526	
R1	Resistor, Fixed, Film: 100 kΩ, 5%, 1/8 W	9	CF1/8-100K/J	09021	
R2	Same as R1				
R3	Resistor, Fixed, Film: 120Ω, 5%, 1/4 W	3	CF1/4-120 OHMS/J	09021	
R4	Same as R3				
R5	Same as R3				
R6	Resistor, Fixed, Film: 10 kΩ, 5%, 1/8 W	3	CF1/8-10K/J	09021	
R7 Thru R9	Same as R1				
R10	Not Used				
R11	Same as R6				
R12	Resistor, Fixed, Film: 47 kΩ, 5%, 1/8 W	6	CF1/8-47K/J	09021	
R13	Same as R1				
R14	Resistor, Fixed, Film: 33 kΩ, 5%, 1/8 W	3	CF1/8-33K/J	09021	
R15	Same as R14				
R16	Resistor, Fixed, Film: 560Ω, 5%, 1/8 W	1	CF1/8-560 OHMS/J	09021	

REF DESIG PREFIX A1A4

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
R17	Same as R1				
R18	Resistor, Fixed, Film: 24 kΩ, 5%, 1/8 W	1	CF1/8-24K/J	09021	
R19	Same as R1				
R20	Same as R1				
R21	Same as R14				
R22	Same as R6				
R23 Thru R27	Same as R12				
U1	Integrated Circuit	1	P80C31BH	34649	
U2	Integrated Circuit	1	MBM27C64-30Z	99999	
U3	Integrated Circuit	2	MM74C374N	27014	
U4	Integrated Circuit	1	MC14161BCP	04713	
U5	Integrated Circuit	1	LM78L05ACH	27014	
U6	Voltage Regulator	1	MC78L15ACP	04713	
U7	Integrated Circuit	1	MC14504BCP	04713	
U8	Integrated Circuit	1	DG212CJ	17856	
U9	Same as U3				
U10	Integrated Circuit	1	AD7226KN	04713	
U11	Integrated Circuit	1	MM74HC373N	27014	
U12	Integrated Circuit	2	MM74C244N	27014	
U13	Not Used				
U14	Same as U12				
U15	Integrated Circuit	1	CD4021BE	02735	
U16	Integrated Circuit	1	TL062CP	01295	
U17	Voltage Regulator	1	MC79L15ACP	04713	
U18	Integrated Circuit	1	TL064CN	01295	
U19	Integrated Circuit	1	AD580JH	24355	
U20	Integrated Circuit	1	CD4094BE	02735	
U21	Integrated Circuit	1	MM74HC08N	27014	
U22	Integrated Circuit	1	MM74HC138N	27014	
U23	Integrated Circuit	1	MM74HC04N	27014	
VR1	Diode, Zener: 10 V	1	IN758A	80131	
XU1	Socket, Integrated Circuit	1	ICN-406-S5-T	06776	
XU2	Socket, Integrated Circuit	1	ICN-286-S5-T	06776	
Y1	Crystal, Quartz: 10.000 MHz	1	CSA10.00MT	72982	

5.5.1.5 Type 371249-1 FM Demodulator Motherboard

REF DESIG PREFIX A1A5

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
A1	IF Bandwidth Option		WJ-9928-XXXX	14632	
A2 Thru A4	Same as A1				
C1	Capacitor, Ceramic, Disc: 4700 pF, 10%, 50 V	12	8111-050-X7RO-472K	59660	
C2 Thru C10	Same as C1				
C11	Capacitor, Ceramic, Disc: 0.1 µF, 20%, 50 V	4	34475-1	14632	
C12	Same as C11				
C13	Capacitor, Ceramic, Disc: 0.47 µF, 20%, 50 V	5	34452-1	14632	
C14	Same as C11				
C15	Same as C11				
C16	Same as C13				
C17	Same as C13				
C18	Capacitor, Electrolytic, Aluminum: 10 uF, ±20%, 25 V	2	ECE-A1EK100	54473	
C19	Same as C13				
C20	Same as C13				
C21	Same as C18				
C22	Same as C1				
C23	Same as C1				
J1	Terminal, Strip	1	65610-110	22526	
J2	Not Used				
J3	Interconnect Strip, Modified	4	170554-1	14632	
J4	Interconnect Strip, Modified	8	170554-2	146323	
J5	Same as J4				
J6	Interconnect Strip, Modified	8	170554-3	14632	
J7	Same as J6				
J8	Same as J3				
J9	Same as J4				
J10	Same as J4				
J11	Same as J6				
J12	Same as J6				
J13	Same as J3				
J14	Same as J4				
J15	Same as J4				
J16	Same as J6				
J17	Same as J6				
J18	Same as J3				
J19	Same as J4				
J20	Same as J4				
J21	Same as J6				

REF DESIG PREFIX A1A5

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
J22	Same as J6				
P1	Pin Socket	5	NS-441-B1	06776	
P2 Thru P5	Same as P1				
R1	Resistor, Fixed, Film: 9.1 kΩ, 5%, 1/4 W	2	CF1/4-9.1K/J	09021	
R2	Resistor, Fixed, Film: 5.6 kΩ, 5%, 1/4 W	2	CF1/4-5.6K/J	09021	
R3	Same as R1				
R4	Same as R2				
R5	Resistor, Fixed, Film: 12 kΩ, 5%, 1/4 W	1	CF1/4-12K/J	09021	
R6	Resistor, Fixed, Film: 1.0 kΩ, 5%, 1/4 W	1	CF1/4-1K/J	09021	
R7	Resistor, Fixed, Film: 62 kΩ, 5%, 1/4 W	1	CF1/4-62K/J	09021	
R8	Resistor, Variable, Film: 100 kΩ, 10%, 1/2 W	1	62PR100K	73138	
R9	Resistor, Fixed, Film: 1.5 kΩ, 5%, 1/4 W	1	CF1/4-1.5K/J	09021	
R10	Resistor, Fixed, Film: 47 kΩ, 5%, 1/8 W	4	CF1/8-47K/J	09021	
R11 Thru R13	Same as R10				
R14	Resistor, Fixed, Film: 100 kΩ, 5%, 1/8 W	5	CF1/8-100K/J	09021	
R15 Thru R18	Same as R14				
U1	Integrated Circuit	2	DG302CJ	17856	
U2	Integrated Circuit	3	MC14052BCP	04713	
U3	Same as U1				
U4	Same as U2				
U5	Same as U2				
U6	Integrated Circuit	1	TL061ACP	01295	
U7	Voltage Regulator	1	MC78L15ACP	04713	
U8	Voltage Regulator	1	MC79L15ACP	04713	

5.5.2 TYPE 271134-3 LED FLEXIBLE BOARD

REF DESIG PREFIX A2

REF DESIG	DESCRIPTION	QTY PER ASSY	MANUFACTURER'S PART NO.	MFR. CODE	RECM VENDOR
DS1	Indicator, LED Tri-Light Red, Yellow, Green	1	L-112-ADC	51628	
DS2	Same as DS1				
DS3	Same as DS1				
P1	Connector, PC Board	1	76314-103	22526	

SECTION VI

SCHEMATIC DIAGRAMS

NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   a. RESISTANCE IS IN OHMS, ±5%, 1/8W
   b. CAPACITANCE IS IN pF
   c. INDUCTANCE IS IN µH

2. DIFFERENCES BETWEEN DASH NUMBERS IS MECHINCAL ONLY.

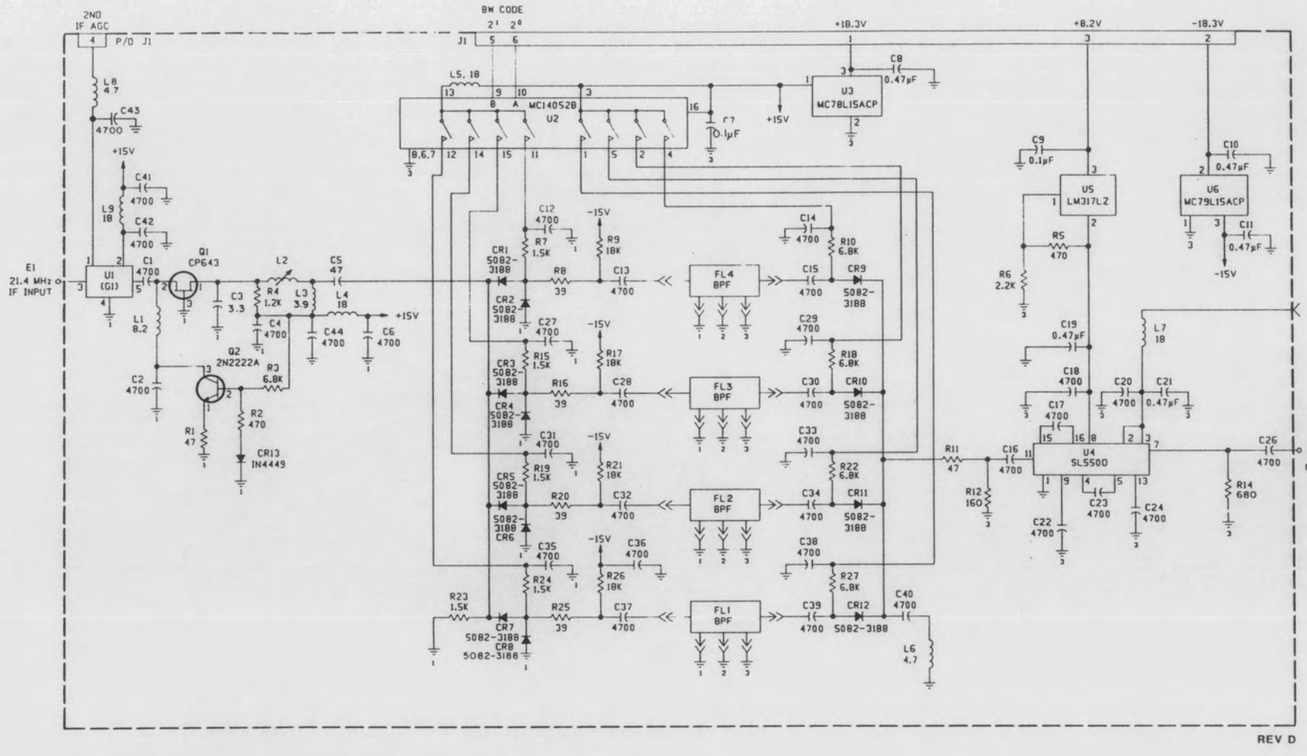
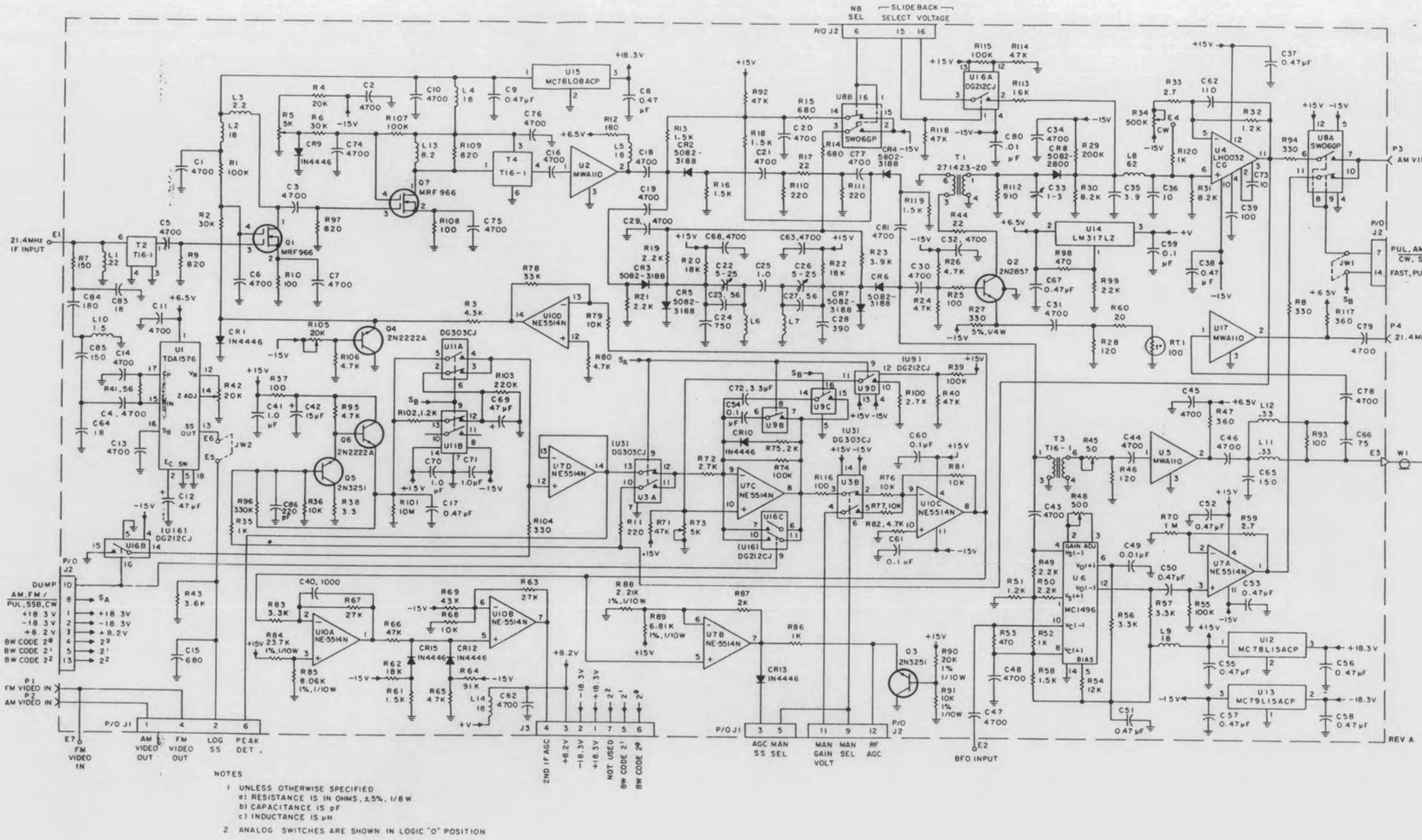


Figure 6-1. Type 371150-2 21.4 MHz Bandpass Amplifier (A1A1), Schematic Diagram 470940

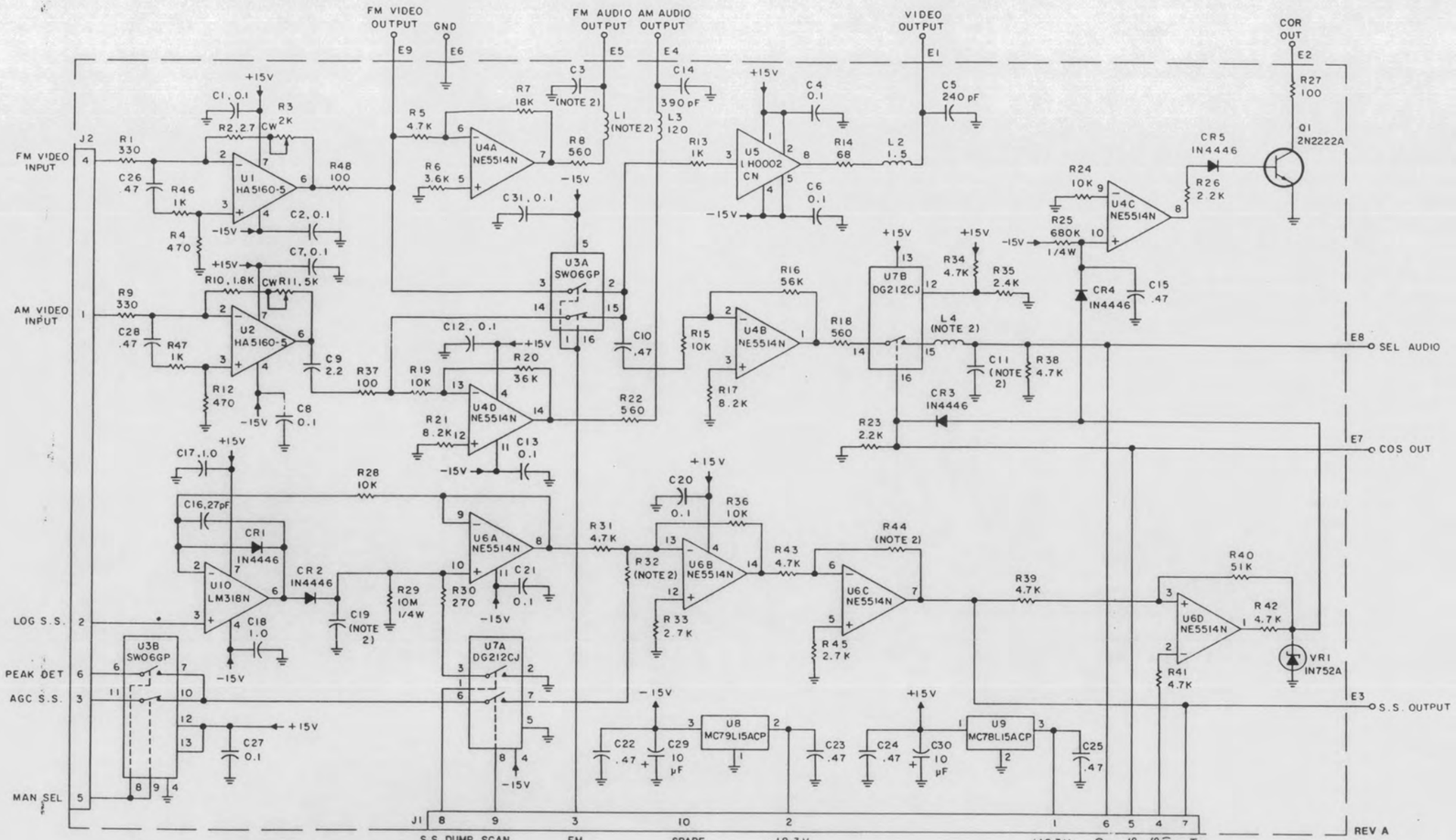


NOTES

1. UNLESS OTHERWISE SPECIFIED
   a) RESISTANCE IS IN OHMS, ±5%, 1/8 W
   b) CAPACITANCE IS pF
   c) INDUCTANCE IS µH
2. ANALOG SWITCHES ARE SHOWN IN LOGIC "0" POSITION

Figure 6-2. Type 371575-1 AM/SSB/CW Demodulator (A1A2), Schematic Diagram 570273

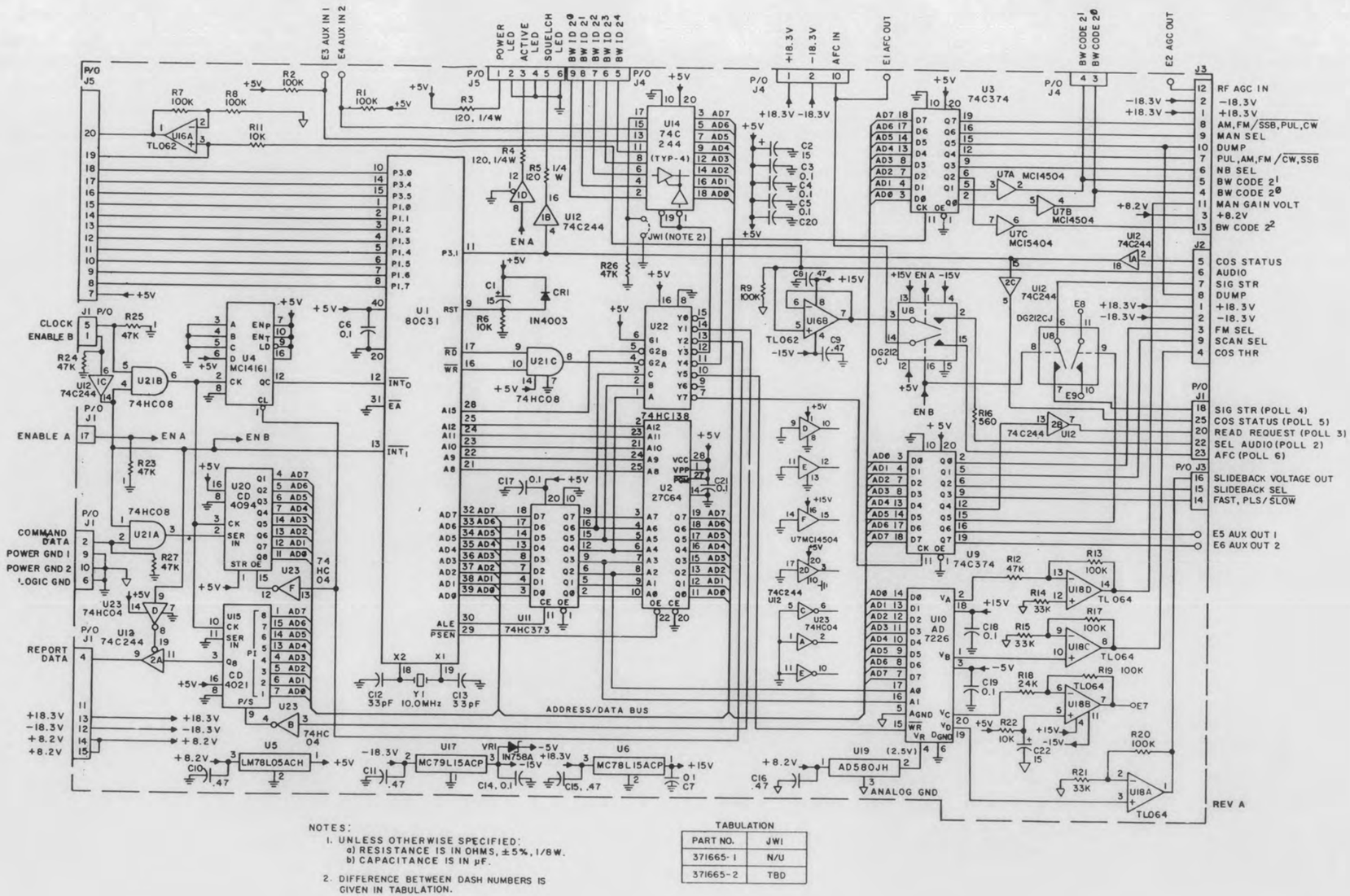
NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS ±5%, 1/8W.
   b) CAPACITANCE IS μF.
   c) INDUCTANCE IS μH.
2. SEE TABULATION FOR DIFFERENCE IN DASH NUMBERS.
3. SWITCHES ARE SHOWN IN LOGIC "0" STATE



TABULATION

DASH NO.	C3	L1	C19	R32	R44	J1	C11	L4
371571-1	390 pF	120	.015	13K	5.6K	9 PIN	390pF	120
371571-2	0.1	68mH	.015	13K	15K	9 PIN	0.1	68mH
371571-3	0.1	68mH	NOT USED	NOT USED	15K	9 PIN	0.1	68mH
371571-4	390pF	120	.015	13K	5.6K	10 PIN	390pF	120

Figure 6-3. Type 371571-1 Video/Audio/COS (A1A3), Schematic Diagram 471097



NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/8W.
   b) CAPACITANCE IS IN µF.
2. DIFFERENCE BETWEEN DASH NUMBERS IS GIVEN IN TABULATION.

TABULATION

PART NO.	JW1
371665-1	N/U
371665-2	TBD

Figure 6-4. Type 371665-1 Digital Interface (A1A4), Schematic Diagram 471332

NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   a. RESISTANCE IS IN OHMS, ±5%, 1/4 W.
   b. CAPACITANCE IS IN µF.
   c. INDUCTANCE IS IN µH.
2. TYPE IS SELECTED FROM TABLE I AS A FUNCTION OF DESIRED IF BANDWIDTH.

TABLE I

IF BW	TYPE NO.
10kHz	371155-1
20kHz	371155-2
50kHz	371156-1
100kHz	371156-2
200kHz	371156-3
500kHz	371158-5
1 MHz	371158-1
2 MHz	371158-2
4 MHz	371158-3
150kHz	371156-4
2.85kHz/SSB	371155-3
300kHz	371158-4
350kHz	371158-6
700kHz	371158-7

TABLE I (Cont.)

IF BW	TYPE NO.
1.4 MHz	371158-8
2.8MHz	371158-9
4kHz	371155-4
7kHz	371155-5
5kHz	371155-6
80kHz	371156-5
420kHz	371158-10
250kHz	371158-11

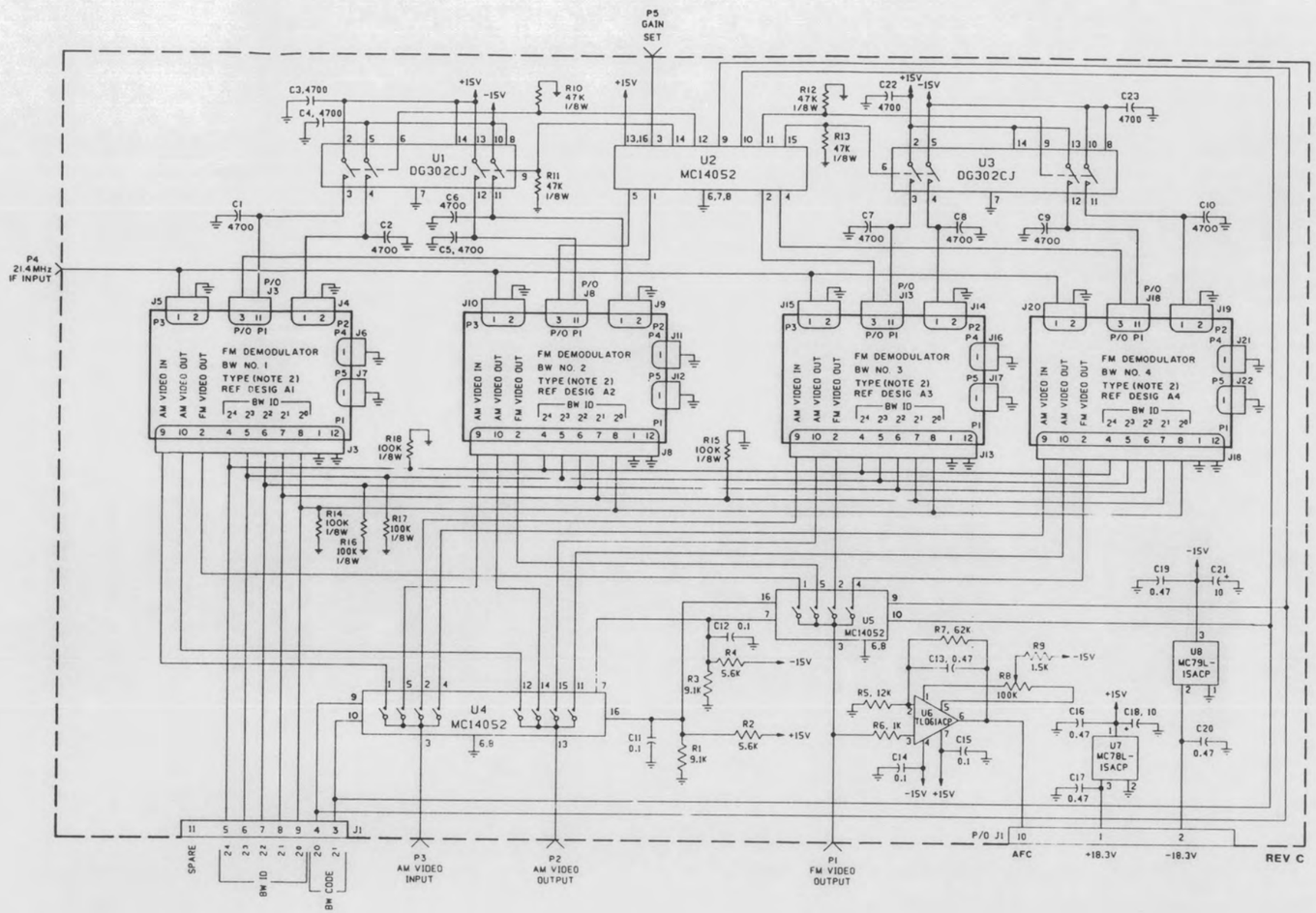


Figure 6-5. Type 371249-1 FM Demodulator Motherboard (A1A5), Schematic Diagram 471035

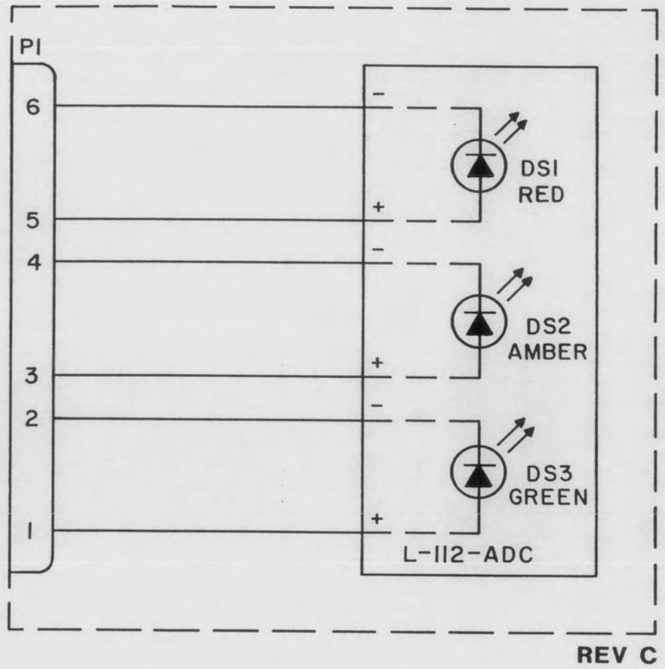


Figure 6-6. Type 271134-3 LED Flexible Board (A2), Schematic Diagram 271135

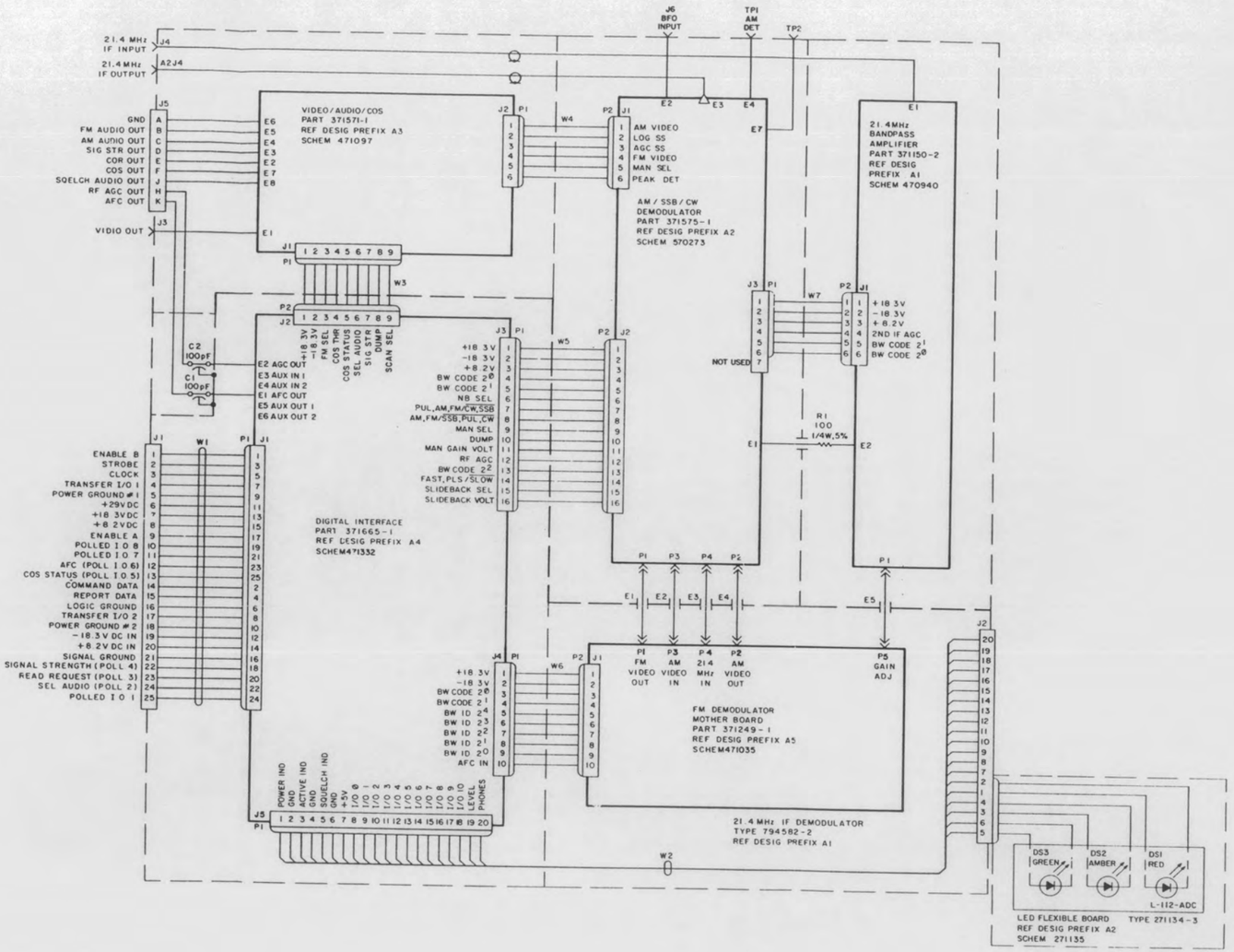


Figure 6-7. WJ-9040 IFD220 IF Demodulator, Main Chassis Schematic Diagram 570403