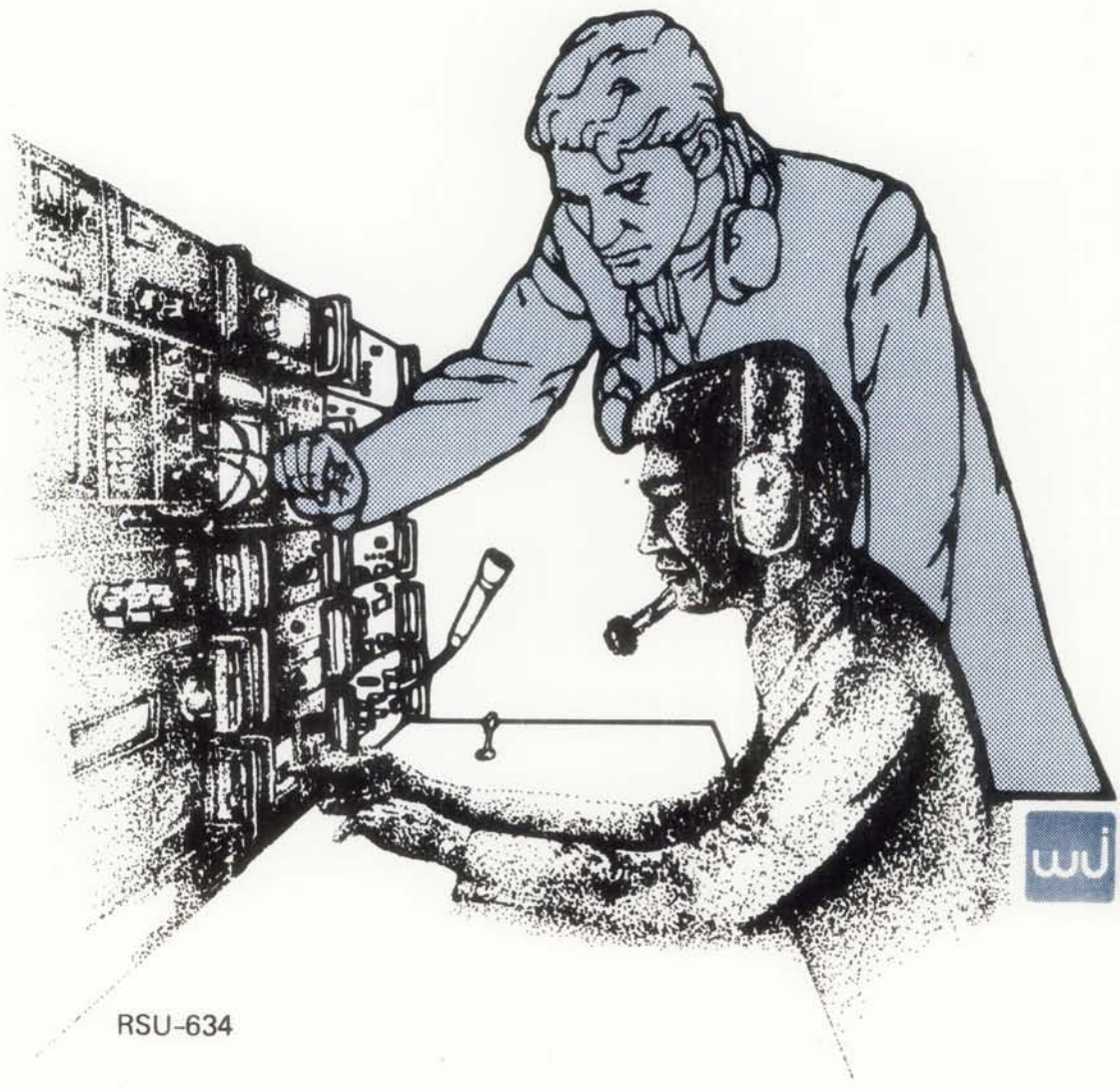
Operation and Maintenance Manual for IF Demodulator/Control Unit, Part of the WJ-8969 Microwave Receiving System



RSU-634

WATKINS-JOHNSON

15 AUGUST 1987

OPERATION AND MAINTENANCE MANUAL
FOR
IF DEMODULATOR/CONTROL UNIT

PART OF THE
WJ–8969 MICROWAVE RECEIVING SYSTEM

WATKINS-JOHNSON

WATKINS-JOHNSON COMPANY
2525 North First Street
San Jose, California 95131-1097

RSU-634

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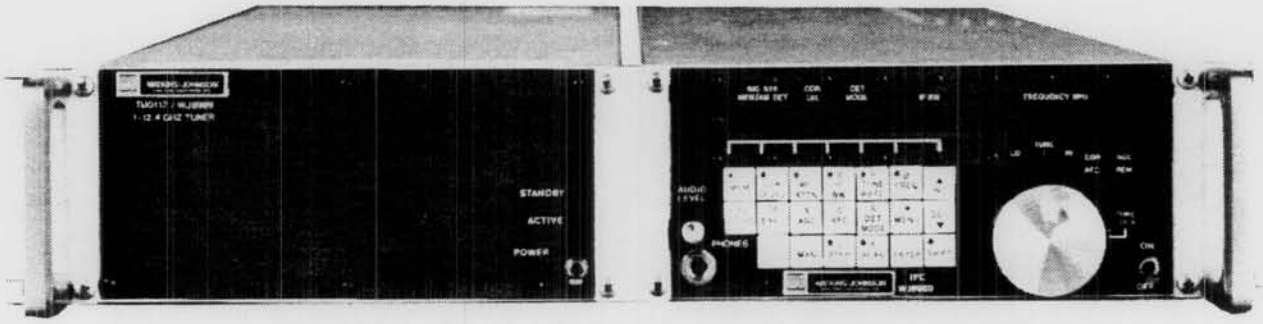

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Figure 1-0. WJ-8969 Microwave Receiving System

CHAPTER I

GENERAL DESCRIPTION

1.1 ELECTRICAL CHARACTERISTICS

1.1.1 OVERVIEW OF IFC UNIT AND WJ-8969 SYSTEM

The WJ-8969 Microwave Receiving System is designed for wideband and narrowband applications in the microwave frequency range. The receiving system's RF tuning range is determined by interchangeable tuner units which provide the RF/IF conversion for the desired frequency range. Five fully synthesized tuner units provide a choice of 1.0 to 4.5, 4.0 to 12.4, 12 to 18, 1.0 to 12.4 or 1 to 18 GHz tuning ranges. Other tuning ranges can also be accomplished for special purposes. Receiver detection modes include simultaneous AM and FM as well as CW (if the 21.4 MHz Converter/Filter Module option is installed) and Pulse. An optional Log detector is also available.

The receiver system is comprised of the WJ-8969/IFC IF Demodulator/Control and the WJ-8969/TUXXXX Tuner Units. These two half-rack units, both 3-1/2 inches high, can be attached side by side and installed in a standard 19-inch equipment frame, or the tuning unit may be installed in a remote location. Signal and control interconnection is provided by a single 50-ohm coaxial cable that can be as long as 300 feet. Using special coaxial cables, this length may be increased up to 1,000 feet. A two-way data link on the same cable permits remote control and status indication of the tuner unit.

Four wideband IF bandwidths (160 MHz center frequency) of the customer's choice are supplied as standard with each receiver. The system can provide up to eight operator-selectable IF bandwidths comprised of four narrowband (10 kHz to 5 MHz) and four wideband (10 MHz to 50 MHz) bandwidths. Other IF bandwidth combinations are possible. The installation of any narrowband IF bandwidth (21.4 MHz center frequency) requires the installation of an optional downconversion module.

All system control is provided via the WJ-8969/IFC IF Demodulator/Controller unit. It permits operator control from its front panel or through an interface with an external remote controlling device via the IEEE-488 interface. When in the local control mode, all system control is exercised via the front panel controls and indicators. The front panel keyboard permits rapid frequency input for discrete frequency tuning, frequency scanning, and stepping up or down in frequency by a designated step size. Conventional tuning can also be accomplished using the front panel optical encoder tuning wheel which provides variable rate tuning to 1 kHz increments. The front panel keyboard provides rapid selection of IF

bandwidths, detection mode, gain control, and tuning rate. A 24-character alphanumeric display simplifies radio operations, particularly the memory and scan functions.

All control settings are prominently displayed for operator viewing. When in remote control mode, the same control functions are exercised by the remote controlling device via the remote interface. The front panel will display the remote selections but the keyboard is disabled to prevent conflicts in the control operation.

Use of the IFC unit front panel is discussed in Section II. This section also includes a detailed description of all controls, indicators, and displays. Additionally, typical operating procedures for the WJ-8969 system and IFC unit are included in Section II.

The rear panel of the IFC unit contains all connectors for the unit, with the exception of the PHONE jack which is contained on the front panel. Section II summarizes the purpose of all connectors and then describes the function of each connector in detail. Figure 2-1, in Section II, shows the rear panel of the unit and Figure 2-2 shows the front panel.

An ac power input connector is contained on the rear panel for cabling a user-supplied 115 or 230 Vac power source to the IFC unit. An IEEE-488 connector enables a user to connect and operate the IFC unit and WJ-8969 system from a remote controller or computer.

Other rear panel connectors provide for 21.4 MHz and 160 MHz IF outputs, AM video, FM video, and Log video (optional) outputs; a line audio (fixed) output, selected video and auxiliary outputs; an external reference input; and a tuner and IFC interconnection.

Section IV details preventive and corrective maintenance procedures and also covers troubleshooting methodologies and procedures. Maintenance operations are straightforward due to clean mechanical packaging and the placement of most components on plug-in circuit boards. These boards are mounted in a card cage or on a motherboard. Test points are accessible on the top of the boards.

Adjustments and alignments have been minimized. Removing the top cover of the IFC unit exposes the assemblies, most of which can be removed from the main chassis with a minimum amount of effort.

1.1.2 RF INPUT CHARACTERISTICS

The WJ-8969 system has a single RF input port which covers the entire input frequency range. The RF input connector is type N and is located on the rear panel of the tuner unit.

1.1.3 FREQUENCY RANGE

The WJ-8969 system is tunable over a frequency range determined by the front-end unit in the tuner. It tunes in synthesized frequency steps of 1 kHz and is tunable from either IFC unit front panel controls or through a remote IEEE-488 interface port located on the IFC unit.

TU0145: 1.0 to 4.5 GHz
TU0412: 4.0 to 12.4 GHz
TU1218: 12 to 18 GHz
TU0112: 1.0 to 12.4 GHz
TU0118: 1 to 18 GHz

1.1.4 TUNING CHARACTERISTICS

The WJ-8969 system uses three conversions with two local oscillators to translate RF input signals to a 160-MHz IF output. The first LO of the RF tuner uses a single loop indirect synthesis technique. The second LO of the RF tuner utilizes a two-loop indirect synthesis technique. The resultant tuning resolution of the RF tuner is 1 kHz.

1.1.5 TUNING RESOLUTION

Tuning resolution of the WJ-8969 system is 1 kHz regardless of the IF bandwidth selected.

1.1.6 FREQUENCY ACCURACY

The frequency accuracy of the WJ-8969 receiver is totally dependent upon the 10 MHz internal crystal oscillator used in the A9-Reference/Multiplexer Module (in the IFC unit) unless an external reference signal is supplied to the system. The stability of the internal crystal and therefore of the WJ-8969 system is 3 parts in 10^7. The frequency accuracy of the system, when provided with an external reference signal, is dependent upon the frequency stability of the supplied reference signal.

1.1.7 EXTERNAL FREQUENCY REFERENCE

The WJ-8969 system uses a 10-MHz crystal oscillator to provide long-term unit stability for the receiver. This crystal oscillator is located in the IFC unit so that the tuner may be remotely located in more extreme environmental conditions. A 50-MHz crystal oscillator, located in the tuner, is phase-locked to the 10-MHz oscillator in the IFC by a very narrow loop bandwidth of approximately 10 Hz. Therefore, the 50-MHz crystal's phase noise dominates at offsets of greater than 10 Hz.

There is an external reference port on the rear panel of the IFC which provides the ability to phase lock the receiver to an external 10-MHz (standard) or 5-MHz (option) signal. The input power to the receiver for the

external reference is 0 ±3 dBm. The phase noise of the external reference need be no less than the following coordinates (offsets greater than loop bandwidth):

Phase Power in a 1-Hz Bandwidth (dBc)	Offset from Carrier (kHz)
-100	0.1
-130	1.0
-140	10.0

The external reference should have an accuracy of ±1 ppm.

1.1.8 PHASE NOISE

The phase noise performance of the WJ-8969 system, at offsets of 100 Hz and greater, is determined by the receiver's internal 50-MHz crystal oscillator and its assorted local oscillators. The system's phase noise performance is therefore independent of the phase noise of an external reference. Table 1-1 contains the SSB phase noise specifications.

1.1.9 RESPONSE TIME

The WJ-8969 uses two synthesized local oscillators. The tuner's first LO is dominant for frequency steps greater than 1 MHz; the second LO is dominant for frequency steps less than 1 MHz. Scan mode takes a step approximately every 38.0 msec. If the step crosses a relay, the delay puts the inter-step time at 133.0 msec. These times may vary 1.0 to 1.5 msec.

Step mode dwell time is more complex. Before a step is taken, the tuner must lock and send a status word. This time varies but after the status word is received (indicating that either the tuner is locked or the tuner software timed-out waiting to lock), there is a 20 msec. dwell. The lock time has only a few discrete time values which depend upon the step-size chosen: 32 to 34 msec, 50 to 52 msec, 67 to 69 msec, 84 to 86 msec, and 120 to 122 msec. Add 20 msec to these times to obtain the time between steps.

1.1.10 GAIN CHARACTERISTICS

The WJ-8969 system allows gain control in both the manual and automatic modes over a 90 dB range, minimum. The gain control range is a result of the voltage-controlled attenuators and fixed gain amplifiers distributed throughout the IFC. Each of four voltage controlled attenuators allows local gain control over a range of approximately 30 dB. this allows a total gain control range of 120 dB. However, a portion of the gain control range is used for bandwidth and cable normalization, so the gain control range is less than 120 dB (90 dB, minimum).

1.1.11 AUTOMATIC GAIN CONTROL

The attack and decay characteristics of the AGC are optimized for pulsed baseband signals when operated in the PULSE mode. A pulse amplitude of 1.6V zero-to-peak (±0.2V) is maintained at the AM video port under the following conditions:

Pulse Width	1 ±0.1 microsecond
Minimum Pulse Repetition Interval	50 microseconds
Maximum Pulse Repetition Interval	10 milliseconds
Minimum (or greater) Selected IF Bandwidth	1 MHz
Maximum RF Input Power	-10 dBm
Minimum RF Power	-55 dBm

The WJ-8969 system incorporates a software AGC function which is superior to traditional hardware AGC loops. The primary advantage to the software AGC is the ability to incorporate multiple AGC characteristics without the need for large amounts of circuitry. In addition, the characteristics of the AGC loop can be modified with ease to satisfy different customer requirements.

The principle behind the software AGC is that the microprocessor is placed at the control point of the loop. It obtains signal level information from the AM and AM peak detectors. The signal level is sampled in a complex manner, and the gain is adjusted automatically for optimum performance. The software AGC characteristics are different for each receiver mode (for different types of received signals) so the AGC loop is not just optimized for pulsed signals. The software AGC is capable of fast attack and response without tracking modulations.

In the pulse mode, the software AGC takes advantage of tools that are not available to the hardware AGC designer, such as sample-and-hold-forever and sample-and-forget routines.

The characteristics of the AGC in the pulse mode are a fast attack, hold, and slow decay. The signal is peak detected over a 25 ms window and the gain is adjusted in coarse steps until the signal level is within a certain range. The fine adjustment algorithm then takes over to maintain the signal within the AM detector's usable range. The AGC then holds the gain constant as long as pulses continue to appear or until 250 milliseconds have passed with no received signal. The gain is increased at a rate of 20 dB every 5 ms thereafter until another signal is encountered.

1.1.12 MANUAL GAIN CONTROL

Manual gain control is provided with a 1 dB resolution. Manual gain control can be exercised via front panel keyboard or over the IEEE-488 interface. Control of voltage controlled attenuators in the IFC is performed by the microprocessor through D/A converters.

1.1.13 AUTOMATIC FREQUENCY CONTROL

This feature is implemented through the AFC key on the IFC unit front panel or via the IEEE-488 interface. AFC is useful to an operator for maintaining a changing or unstable RF signal within the receiving passband. Note, however, that the AFC feature is not functional in the BW filter bypass mode.

When AFC is selected, it is active only when the COR level indicator is lighted (meaning that a selected signal has exceeded the COR level threshold). When active, AFC tunes the tuner to maintain the signal in the center of the tuner's passband. The pull-in range depends on the signal strength and the accuracy of the AFC function is dependent on the selected bandwidth.

1.1.14 IF CHARACTERISTICS

1.1.14.1 IF Center Frequencies

The WJ-8969 system's IF center frequencies are 160 and 21.4 MHz (optional). The composite signal from Tuner to IFC includes a 160 MHz IF signal. The 160 MHz IF signal is downconverted to 21.4 MHz inside the IFC. Both the 160 and 21.4 MHz IF signals are available at the rear panel of the IFC.

1.1.14.2 IF Bandwidths

The IFC unit has eight slots for IF bandpass filters, four centered at 160 MHz and four centered at 21.4 MHz. The 160 MHz filters available range from 10 MHz to 50 MHz, while the 21.4 MHz filters are offered in the range from 0.01 MHz to 5.0 MHz.

The filters are plug-in types and are easily field replaceable. If the filters are to be changed, a plug-in equalizer pack must also be changed so that the microprocessor can interrogate the demodulator at power-on to determine what filters are currently installed. The mean time to replace IF filters and associated equalizer pack in a single system is less than one hour.

The WJ-8969 system incorporates IF bandpass filters with a maximum shape factor of 4:1. For the 160 MHz filters, the resultant filter design yields a seven-section symmetrical phase and gain response, which is optimized for NPR performance.

1.1.14.3 Auxiliary IF Outputs

The WJ-8969 receiver provides three IF outputs consisting of a 160-MHz IF output, a 21.4-MHz IF output, and a switched IF output. The 160 MHz and 21.4 MHz IF outputs are referred to as signal monitor or SM outputs. The 160-MHz IF output is available prior to any IF bandwidth selective filtering. The 21.4 MHz IF output is provided with an appropriate 8 MHz IF bandwidth. The output impedance of the IF outputs is 50 ohms and

will not exceed a VSWR of 1.5:1. The gain from the IF input port of the IFC to the 160 MHz and 21.4 MHz SM (signal monitor) outputs are approximately 0 and 5 dB ± 2 dB respectively.

1.1.15 IMAGE REJECTION

The receiver's image rejection is 70 dB minimum. For center tuned frequencies between 1 to 4 GHz, image rejection is determined by both the preselector filter and the single low pass filter following the preamplifiers. For center tuned frequencies between 4 to 12 GHz and 12 to 18 GHz, the image rejection is determined by the combined pre- and post-selected YIG filter rejection at the image frequency. This filter has greater than 70 dB total rejection with respect to its insertion loss at the image frequencies.

1.1.16 VIDEO OUTPUT CHARACTERISTICS

The WJ-8969 system provides both AM linear and FM video output in addition to a switched video output. Unused ports must be terminated with a 50-ohm BNC terminator.

1.1.16.1 FM Video and Switched Video Out

When in the FM Detection Mode, the following outputs are available:

FM-Output: -0.5 Vdc to +0.5 Vdc ±0.05 Vdc, equivalent to 1 volt peak-to-peak, dc-coupled.

Switched Video Output: -1.0 Vdc to +1.0 Vdc ±0.01 Vdc, equivalent to 2 volts peak-to-peak, dc-coupled.

1.1.16.2 AM Video and Switched Video Output

The switched video and AM video output levels, when operating in the AM mode, is 2 volts ±0.2 volts zero-to-peak for an 80% amplitude modulated carrier terminated into 50 ohms. The output does not saturate at less than 2.5 volts. The AM outputs are dc-coupled.

1.1.16.3 AM Output Distortion

The selected video output exhibits less than 3% of harmonic distortion when demodulating a 90% amplitude modulated carrier when the modulation signal frequency is significantly less than 1/2 the selected IF bandwidth for all IF bandwidths.

1.1.16.4 Impedance

The output impedance of the selected video output, AM output, and FM output are each controlled by resistors in the circuits and are set to 50 ohms.

1.1.16.5 Video Bandwidth

When selecting the AM detection mode, the video bandwidth of the selected video output is greater than 25 MHz. Thus, the demodulated signal video frequency response is determined by the IF bandwidth selected and is, typically, extending from dc to one-half the selected IF bandwidth.

When the FM detection mode is selected, an equalizer circuit is switched into the FM video amplifier in order to set the output level as stated in paragraph 1.1.16.1. In addition, the equalizer controls the FM video bandwidth. The equalizer sets the FM video bandwidth at one-half of the IF bandwidth in order to limit the wide band noise that is present in FM demodulation. As a result of these equalizers. the FM video frequency response extends from dc to one-half of the selected IF bandwidth.

1.1.17 AUDIO OUTPUT CHARACTERISTICS

Two audio outputs are available for listening to FM, standard type AM, and pulse transmissions.

a. Variable - a PHONES connector and AUDIO LEVEL control on the IFC unit front panel provide this feature. The connector is intended to drive an unbalanced 600-ohms stereo headphone set. Active only when COR threshold is exceeded.

b. Fixed - a BNC connector on the IFC unit provides this feature. The audio level is adjustable by a potentiometer accessible through the rear panel of this unit. The connector can drive a 50-ohm source.

1.1.17.1 Fixed Audio Connector (J12) Audio Specifications

The following lists the typical minimum and maximum voltage output levels for (1) a 50-ohm load, (2) AM modulation, and (3) with AGC on.

Modulation %	Minimum	Maximum (millivolts)
95	0.00V	250
75	32mV	220
50	64mV	195
10	110mV	143
0	130 mV	130

1.1.17.2 PHONES Connector Audio Specifications

The following lists the typical minimum and maximum voltage output levels for (1) an unbalanced 600-ohms stereo headphone set, (2) AM modulation, (3) AGC on, and (4) COR active. The first listing assumes a 50-ohm load on the fixed audio output, the second listing assumes no 50-ohm load on the fixed audio output.

50-Ohm Load on Fixed Audio Output Connector

Modulation %	Minimum (Volts)	Maximum (Volts)
95	-0.32	0.35
80	-0.30	0.30
60	-0.23	0.22
40	-0.15	0.15
20	-0.07	0.075
10	-0.038	0.040

W/O 50-Ohm Load on Fixed Audio Output

Modulation %	Minimum (Volts)	Maximum (Volts)
95	-1.40	1.40 (clipped)
80	-1.20	1.20
60	-0.93	0.90
40	-0.60	0.60
20	-0.31	0.31
10	-0.15	0.15

1.1.18 LOCAL CONTROL

Local control of the WJ-8969 system is provided by the front panel of the IFC unit. The front panel of the IFC unit allows an operator to control the following parameters of the system; tuned RF frequency; IF bandwidth (one of up to eight IF bandwidths if option AA is installed); IF attenuation (0 to 90 dB); detection modes (AM, FM, CW, and Pulse); receiver scan modes (step or scan); automatic gain control (on/off); automatic frequency control (on/off); memory/receiver configuration; carrier operated relay (COR) threshold; and lockout frequencies audio gain.

1.1.19 REMOTE CONTROL

Remote control and status reporting of the WJ-8969 system is provided through the IEEE-488 interface bus. The IEEE-488 interface bus permits the control of all front panel operation. Control resolution, in the remote control mode, is not degraded. In addition, all displayed information and the results of the built-in-test function are available on the IEEE-488 interface bus.

The IEEE-488 interface provides talk and listen capabilities to implement the following standard IEEE-488 functions.

SH1	Source handshake
AH1	Acceptor handshake
T6	Basic talker with serial poll
L4	Basic listener with serial poll
SR1	Service Request
DC1	Device clear

1.1.20 BUILT-IN-TEST

The WJ-8969 system provides for built-in-test functions. Fault detection within the receiving system is dynamic and therefore does not necessitate an operator to be cognizant of a possible error before initiation of the self-test function. The system fault error messages include:

1. First LO unlocked;
2. Second LO unlocked;
3. Reference signal is unlocked;
4. Calibration error - tuner cable;
5. Tuner not responding;
6. A to D converters are not converting;
7. No IF bandwidths found; and
8. Illegal bandwidth codes in the receiver.

The messages are displayed on the front panel of the IFC unit. The exact formats for the messages and other technical details are contained in Section IV of this manual.

The first three messages pertain the the phase-locking of the two LOs and the 50 MHz crystal reference. These devices are checked continuously for phase-lock. The other five messages can appear only during the "Power-Up" sequence since the devices associated with these messages are checked only during the power-up sequence.

1.1.21 PRIME INPUT POWER

Voltage and power requirements for prime input power for the receiving system are 115/230 Vac (switch selectable on each unit), single phase, 47 to 400 Hz operation. Power consumption of the WJ-8969 depends upon the system configuration:

a. 40 Watts, IFC unit;
b. 55 Watts, tuner (half rack); and
c. 75 Watts, tuner (full rack).

When the WJ-8969 receiver consists of two half-rack mount chassis, prime input power needs to be provided to both the RF tuner and IFC chassis.

1.2 MECHANICAL CHARACTERISTICS

The following are the dimensions (in inches/centimeters) of the system units. See Figure 6-28 for a typical system outline drawing.

IFC - 3.5/8.89 (H) x 8.25/20.95 (W) x 20.0/50.8 (L)
TU0112 - 3.5/8.89 (H) x 8.25/20.95 (W) x 20.0/50.8 (L)
TU0145 - 3.5/8.89 (H) x 8.25/20.95 (W) x 20.0/50.8 (L)
TU0412 - 3.5/8.89 (H) x 8.25/20.95 (W) x 20.0/50.8 (L)
TU1218 - 3.5/8.89 (H) x 8.25/20.95 (W) x 20.0/50.8 (L)
TU0118 - 3.5/8.89 (H) x 16.50/41.91 (W) x 20.0/50.8 (L)

All operating controls, indicators, and displays are contained on the front panel, while all input and output cables, except for the PHONE jack, are connected to the rear panel connectors.

1.2.1 ACOUSTIC NOISE

Normal voice conversations can be carried on without raising the voice level. This means that a system chassis does not exceed 24 dBa acoustic noise at a distance of one meter.

Hazardous noise is interpreted by the Watkins-Johnson Company to mean acoustic noise exceeding 110 dBa at a distance of 0.25 meters to approximately 80 dBa at a distance of approximately four meters. The WJ-8969 system acoustic noise level is far below this type of acoustic noise.

1.2.2 STANDARDS OF MANUFACTURE

The WJ-8969 system is built in accordance with best commercial practices and workmanship standards, using MIL-STD-454 as guidelines. Fabrication of piece parts follow best commercial practices. Assembly, soldering and wiring follow Watkins-Johnson Company workmanship standards. Testing is conducted at the appropriate level to measure the functional performance using approved test procedures.

1.2.3 CHASSIS ENCLOSURES

The equipment chassis are designed so that replaceable components are readily accessible. All chassis covers are easily and completely removable, providing access to the internal SRUs where necessary for maintenance purposes. The weight of the IFC unit is nominally 21 pounds (9.53 kg). The weights of the tuners are as follows: all half-rack tuners are nominally 25 pounds (11.35 kg); the full-rack tuner is nominally 30 pounds (13.62 kg).

The WJ-8969 system is designed to facilitate the adjustment, testing, repair, or replacement of any component with a minimum of mechanical or electrical disconnection within the system operating constraints. Service loops are incorporated where possible/necessary for performance of maintenance activities. General purpose technician tools are sufficient for most

maintenance actions, but special tools, materials, and devices are needed where required by the maintenance procedures discussed in Section IV of this manual.

1.3 ENVIRONMENTAL CONDITIONS

1.3.1 NONOPERATING ENVIRONMENTAL CONDITIONS

The WJ-8969 system will survive, without damage or permanent performance degradation, the environmental conditions specified below:

a. Temperature: -20°C to +80°C/-4°F to +176°F

b. Relative Humidity: Up to 100 percent with condensation (condensed moisture must be removed and humidity established as noncondensing prior to restoration of operation)

c. Atmospheric Pressure: 25 to 32 inches of mercury

d. Strain, jars, vibrations, or other conditions incident to normal maintenance, transportation, and handling.

1.3.2 OPERATING ENVIRONMENTAL CONDITIONS

The WJ-8969 system equipment can be installed and operated in an air-conditioned environment. The conditioned air can be introduced into the bottom of the rack and exited at the top of the rack.

The WJ-8969 system equipment meets all performance requirements when operated indoors in the following environment:

a. Ambient Temperature: 0°C to 50°C/32°F to 122°F;

b. Relative Humidity: Up to 80 percent without condensation; and

c. Barometric Pressure: 25 to 32 inches of mercury.

1.3.3 TRANSPORTABILITY

The WJ-8969 system equipment can be transported by commercial land carriers or pressurized commercial air carriers without special handling provisions.

1.4 SYSTEM CONFIGURATIONS

The typical WJ-8969 system is a simple configuration consisting of two units, the IFC and the RF tuner unit. When both units are mounted side by side, they encompass one 19-inch rack, 3-1/2 inches high. For semiremote applications, the tuner may be located away from the IFC by as much as 300 feet using a standard cable or up to 1,000 feet using special low loss cable. The single interconnecting cables relieves typical problems

associated with multiple interconnecting cables. This same configuration can easily accommodate multiple receiver systems using IFCs and tuner units in matched sets as needed.

1.5 SUMMARY OF WJ-8969 SYSTEM SPECIFICATIONS

Tables 1-1 and 1-2 summarize the WJ-8969 system specifications.

Table 1-1. WJ-8969 System Specifications

Tuning Scheme	Frequency synthesized local oscillators locked to an internal or external frequency reference
Frequency Range	Determined by tuner unit: TU0145 1.0 to 4.5 GHz TU0412 4.0 to 12.4 GHz TU1218 12 to 18 GHz TU0112 1.0 to 12.4 GHz TU0118 1 to 18 GHz (Other ranges may also be accomplished, including below 1 GHz and above 18 GHz)
Frequency Resolution	1 kHz, synthesized
Input Reference Frequency	10 MHz, standard 5 MHz, optional
Internal Reference Accuracy	3 parts in 10^7
Noise Figure	1 to 12 GHz: 15 dB, maximum; 11 dB, typical 12 to 18 GHz: 17 dB, maximum; 13 dB, typical
Noise Power Ratio	40 dB, typical
Third Order Intercept	0 dBm, typical
Image Rejection	70 dB, minimum

Table 1-1. WJ-8969 System Specifications - Continued

SSB Phase Noise	1 to 12 GHz (dBc/Hz max)	12 to 18 GHz (dBc/Hz max)	fo
	-80	-74	1 kHz
	-83	-77	10 kHz
	-98	-92	100 kHz
	-118	-112	1 MHz
RF-to-IF Gain (RF input to 160 SM output)	18 dB, typical (system does self-calibration to adjust for IF cable losses during power-on cycle)		
RF Input Impedance	50 ohms, nominal		
LO Level at RF Input	-90 dBm, typical		
Single-tone Spurious Free Dynamic Range	60 dB, minimum; 65 dB, typical (referenced to a 1 MHz measurement bandwidth)		
Input 1 dB Compression Point	-10 dBm, minimum		
Internally Generated Spurs	Not above noise floor in 1 MHz resolution bandwidth		
Tuner IF	160 MHz center frequency		
RF Input VSWR	2.0:1, typical; 2.5:1, maximum		
Gain Control	Manual and AGC		
Gain Control Range	0 to 90 dB, 1 dB steps		
Demodulation	AM, FM, CW and Pulse		
Selectable IF Bandwidths	Up to eight installed. Four centered at 160 MHz and four centered at 21.4 MHz. See Table 1-2 for values. Consult Factory for details on 70 MHz center frequency option.		
Video Outputs	AM (Linear) FM Selected (panel selection) AM (Log) - optional		
Video Response	DC to 1/2 selected IF bandwidth		

Table 1-1. WJ-8969 System Specifications - Continued

Video Output Levels	AM (Lin): 0 to 2 Volts, dc coupled FM: ±0.5 Volts, dc coupled AM (Log): 0.2 to 2.0 Volts, dc coupled
Video Output Impedance	50 ohms, nominal
IF Outputs (Signal Monitor)	160 MHz unfiltered; 50 MHz BW, typical 21.4 MHz (optional); 8 MHz BW, typical Switched IF filtered; 70 MHz (optional - consult factory for details)
Signal Monitor Output Impedance	50 ohms, nominal
Audio Outputs	Phone (600 ohm) and line (50 ohm)
Remote Control	IEEE-488
Dimensions (inches/centimeters)	IFC - 3.5/8.89 (H) by 8.25/20.95 (W) by 20.0/50.8 (L) TU0112 - 3.5/8.89 (H) by 8.25/20.95 (W) by 20.0/50.8 (L) TU0145 - 3.5/8.89 (H) by 8.25/20.95 (W) by 20.0/50.8 (L) TU0412 - 3.5/8.89 (H) by 8.25/20.95 (W) by 20.0/50.8 (L) TU1218 - 3.5/8.89 (H) by 8.25/20.95 (W) by 20.0/50.8 (L) TU0118 - 3.5/8.89 (H) by 16.50/41.91 (W) by 20.0/50.8 (L)
Weight	IFC: 21 pounds (9.53 kg) Tuner (half rack): 25 pounds (11.35 kg) Tuner (full rack): 30 pounds (13.62 kg)
Temperature Range	Operating: 0 to 50°C (32 to 122°F) Nonoperating: -20 to +80°C (-4° to +176°F)
Power Requirements	115/230 Vac ±15% (switch selectable) 47 to 400 Hz, single phase IFC: 40 Watts Tuner (half rack): 55 Watts Tuner (full rack): 75 Watts

Table 1-2. Available IF Bandwidths*

IF BW (kHz)	Center Frequency (MHz)	IF BW (kHz)	Center Frequency (MHz)
10	21.4		
20	21.4	10000	160
50	21.4	14000	160
100	21.4	15000	160
200	21.4	20000	160
250	21.4	22000	160
300	21.4	28000	160
500	21.4	30000	160
1000	21.4	36000	160
2000	21.4	50000	160
4000	21.4	*	160
5000	21.4		

*Other IF bandwidths are available upon request. Customers may select a maximum of four narrow (centered at 21.4 MHz) and four wide (centered at 160 MHz) IF bandwidths.

CHAPTER II

INSTALLATION AND OPERATION

2.1 UNPACKING AND INSPECTION

Examine the shipping carton for damage before the WJ-8969/IFC Demodulator and Controller unit is unpacked. If the carton has been damaged, try to have the carrier's agent present when the equipment is unpacked. If not, retain the shipping cartons and padding material for the carrier's inspection if damage to the equipment is evident after it has been unpacked.

See that the equipment is complete as listed on the packing slip. Contact Watkins-Johnson Company, San Jose, California; or your local Watkins-Johnson representative with details of any shortage.

The unit was thoroughly inspected and factory adjusted for optimum performance prior to shipment. Thus it is 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 and internal damage is suspected, notify a Watkins-Johnson Company representative. Do not remove the covers from the unit. This breaks the QA seal and voids the warranty.

2.2 PREPARATION FOR RESHIPMENT AND STORAGE

If the WJ-8969/IFC must be prepared for reshipment, the packaging methods should follow the pattern established in the original shipment. If retained, the original materials can be used to a large extent or will at a minimum provide guidance for the repackaging effort. Conditions during storage and shipment should normally be limited as follows:

1. Maximum humidity: 95% (no condensation)

2. Temperature range: -20°C to +80°C (-4°F to +176°F).

2.3 INSTALLATION

The WJ-8969/IFC is designed for mounting in a standard 19-inch equipment rack. It occupies 3.50 inches of vertical rack space, is 8.25 inches wide, and extends approximately 20.75 inches into the rack to the tips of the rear connectors. The tuning control knob extends approximately 1.00 inches from the front panel base plate. Do not rely solely on front panel mounting hardware to support the receiver. A brace extending along the sides from the front panel to the rear panel is preferred. The rack should allow a free flow of air through top and bottom covers and side panels, as well as around the outer surfaces of the unit. The rack slides recommended for the IFC are the Johannson 1102D-20-2.

The unit weighs nominally 21 pounds (9.53 kg) and can be lifted safely, by a trained technician, without using a lifting device.

Access to the rear panel should be allowed so that input and output connections can be conveniently made or changed if desired. Figures 2-1 and 2-2 are photographs of the rear and front panels showing the locations of the connectors.

The following describes the functions and input/output parameters of each connector. A technician can trace the origins of the connector's signal sources by using Figure 6-1 (sheets 1 and 2) in Section VI. This figure is a functional block diagram of the WJ-8969/IFC.

2.3.1 AC POWER INPUT (J1)

This POWER connector is a multipin connector cabling a user-supplied ac power source (115/230 Vac, 47 to 400 Hz) to the +5 and ±15 Vdc power supply in this unit. Figure 2-1 shows the location of the voltage select switch which has a 115 or 230 position. The setting of the switch depends on the voltage level of the ac power source. The switch is shown in the 115 position. Fuse F1 is a 0.75 ampere slow-blow type and can be used for either 115 Vac or 230 Vac input power.

2.3.2 IEEE-488 CONTROL (J2)

This connector is a IEEE-488 type for permitting remote control of the WJ-8969/IFC and WJ-8969 Microwave Receiver System. When this remote control is used, all WJ-8969/IFC front panel control functions are implemented by the remote controlling device through the IEEE-488 interface. The front panel displays the remote selections but the keyboard is disabled.

2.3.3 AUXILIARY OUTPUTS (J3)

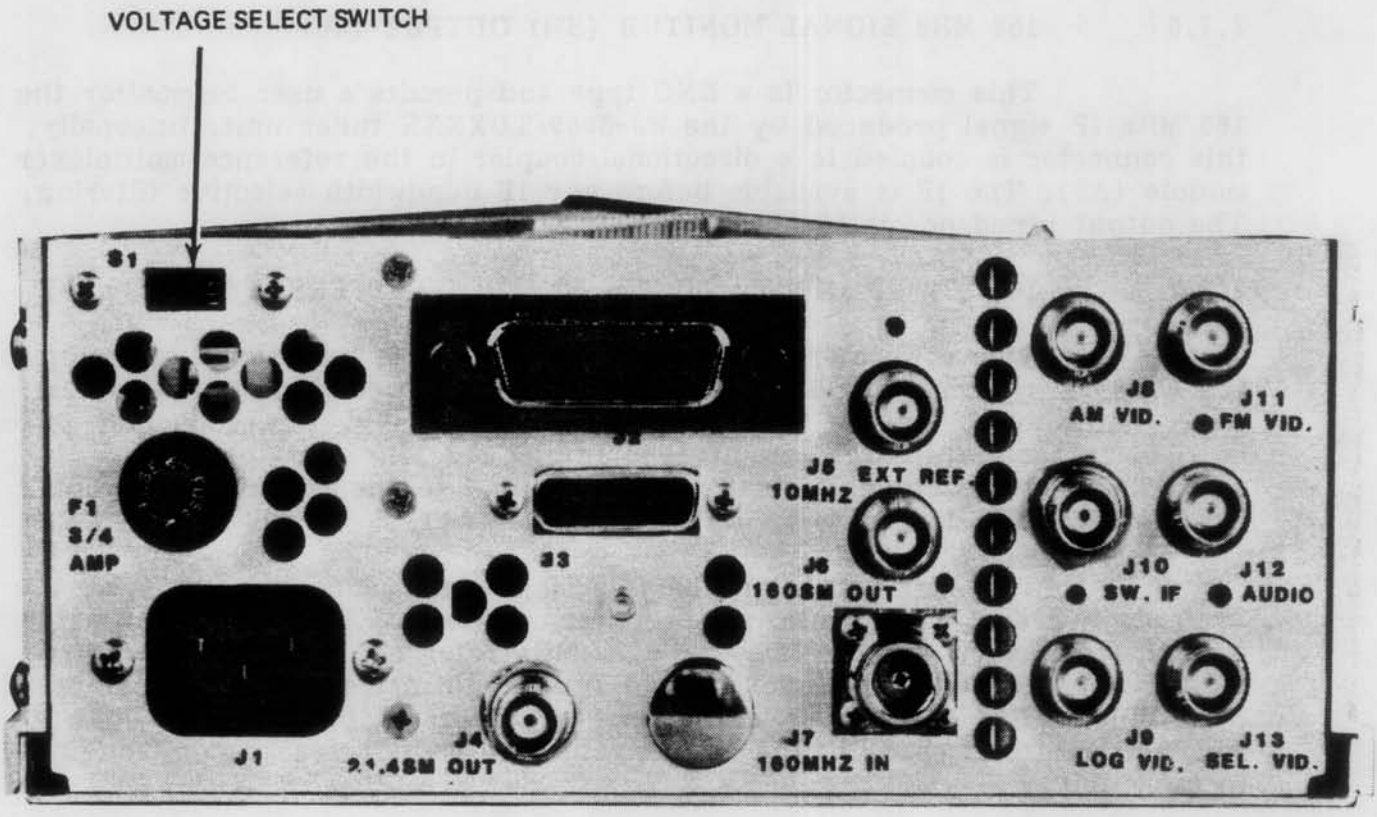
Currently, a TTL signal to indicate COR on/off and a TTL signal to indicate IF invert/non-invert are available at this connector. Other pins are available for future use and system expansion.

2.3.4 21.4 MHz SIGNAL MONITOR (SM) OUTPUT (J4)

This connector is a BNC type and permits a user to monitor the 21.4 MHz IF signal produced in the unit by the 21.4 MHz Converter/Filter module (A12). The output is provided with a 8 MHz IF bandwidth. The output impedance is 50 ohms.

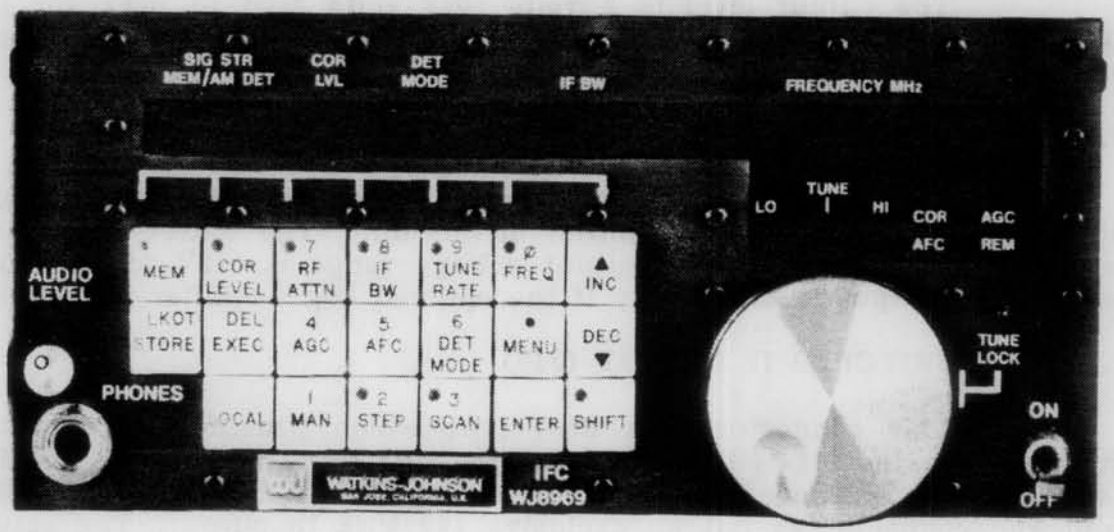
2.3.5 10 MHz EXTERNAL REFERENCE INPUT (J5)

This connector is a BNC type and permits a user to supply a 10 MHz external reference source to the unit in lieu of the internally generated 10 MHz reference produced by the 10 MHz reference circuit card in the reference/multiplexer module (A9). Internally, the circuit disables operation of the 10 MHz reference generator circuit when the presence of a 10 MHz external reference is detected. As an option, the unit can be equipped to accept a 5 MHz external reference input.



11362-1

Figure 2-1. Rear Panel of the WJ-8969 IFC



13637-4

Figure 2-2. Front Panel of WJ-8969 IFC

2.3.6 160 MHz SIGNAL MONITOR (SM) OUTPUT (J6)

This connector is a BNC type and permits a user to monitor the 160 MHz IF signal produced by the WJ-8969/TUXXXX tuner unit. Internally, this connector is coupled to a directional coupler in the reference/multiplexer module (A9). The IF is available before any IF bandwidth selective filtering. The output impedance is 50 ohms.

2.3.7 160 MHz IF INPUT, TUNER CONTROL, REFERENCE SEND (J7)

This connector is a N type female and is used for connecting the WJ-8969 system's single 50 ohm coaxial cable between this unit and rear panel connector J3 on the WJ-8969/TUXXXX. Internally, this connector is coupled to the multiplexer circuit card in the reference/multiplexer module (A9). Connector J3 on the tuner unit is coupled to the multiplexer circuit card in the tuner reference/multiplexer module (A1).

The composite signal on this single interconnecting cable for the system's IFC and tuner units contains half duplex data, the tuner unit's 160 MHz IF frequency, and the IFC unit's 10 MHz reference signal. These three signals are frequency multiplexed onto this single cable. Multiplexing and demultiplexing of the signals and data are performed by the respective multiplexer circuit cards in the similar reference/multiplexer module contained in each unit.

2.3.8 AM VIDEO OUTPUT (J8)

This connector is a BNC type which provides an amplitude modulated (AM) video produced in the AM detector circuits contained on the demodulator module (A11) of this unit. The source impedance of this connector is 50 ohms.

The output level is 2 volts ±0.2 volts zero to peak for a modulated carrier. The output does not saturate at less than 2.5 volts and is dc-coupled.

2.3.9 LOG VIDEO OUTPUT (J9)/OPTIONAL

This connector is a BNC type and provides logarithmic video produced by the optional Log Amplifier in this unit. The source impedance of this connector is 50 ohms. The output voltage range is 0.2V to 2.0 Vdc. However, the output is active only if the optional Log Amplifier is installed.

2.3.10 SWITCHED IF OUTPUT (J10)

This connector is a BNC type which provides an output containing both the 21.4 MHz IF and the 160 MHz IF. This can be considered as an auxiliary IF connector since connector J4 has an exclusive 21.4 MHz IF output and connector J6 has an exclusive 160 MHz IF output. The actual output frequency depends on whether the selected IF bandwidth is centered at 160 MHz or 21.4 MHz. The output occurs after IF filtering and gain control.

The IF output at J10 is switched between 21.4 MHz and 160 MHz. The paths of these respective IFs is worth noting for possible troubleshooting purposes. Figure 6-1 (sheets 1 and 2), in Section VI, is used to show these paths.

On sheet 2 of 2, at the upper left side, note that an IF input comes from the 160 MHz Filter/Gain module (A10). This IF is power split twice before going through a -20 dB fixed attenuator and then to J10 (which is shown diagrammatically on the upper middle right side of sheet 2).

Referring to sheet 1 of 2, note that both the 21.4 MHz and 160 MHz IF go to the 160 MHz Filter/Gain module (A10). This module contains the control logic for switching the IFs at the output of J10. Both IFs are ultimately amplified by the +34 dB amplifier shown at the right side of the module's diagram and go to module A11.

2.3.11 FM VIDEO OUTPUT (J11)

This connector is a BNC type which provides a video output produced in the FM detector circuits contained on the demodulator module (A11) and then sent through equalizer circuits before being connected to a video amplifier/line driver. The output of this amplifier is applied to connector J11.

The source impedance of this connector is 47 ohms for driving 50-ohm loads. However, the impedance can be changed to 75 ohms (at the factory only) by changing resistors (R41 and R51) located in demodulator module (A11).

The output level is -0.5 to +0.5 volts, within ±0.05 volts, for a FM carrier having a peak-to-peak deviation equal to the selected IF bandwidth.

2.3.12 LINE AUDIO OUTPUT/FIXED (J12)

This connector is a BNC type which provides a fixed audio level output for user purposes. The output level can be adjusted by an internal potentiometer (R19) located on the video switcher circuit card (CCA A11A2) located in the demodulator module (A11) and accessible through the rear panel.

The audio output can be used for listening to FM and standard type AM signals, and also to pulse transmissions. Internally, unstretched video is used for developing the FM and standard AM audio signals, while stretched video is used for pulse-type audio.

An operator-controlled audio level output is also available at the PHONES connector on the unit's front panel.

2.3.13 SELECTED VIDEO OUTPUT (J13)

This connector is a BNC type which provides an output of the video (AM, FM, CW, and pulse) selected by the operator via the front panel DET MODE key. When the FM detection mode is selected, the output level is -1.0 Vdc to +1.0 Vdc ±0.01 Vdc (which is equivalent to 2 volts peak-to-peak). This is two times the FM video output at connector J11.

2.3.14 PHONES (J14)

This connector is a phone jack intended to drive a 600-ohms (or greater) stereo headphone set. This PHONES jack is located on the front panel of the unit. The audio level is adjustable by the front panel AUDIO LEVEL control.

2.4 OPERATION

All front panel controls, indicators, and displays are described here. The control panel is human-engineered to be operator-friendly and to eliminate the need for operator mental conversions when interpreting displayed information. All controls, indicators, displays, and pushbuttons are configured for operator ease of use and for quick access.

The front panel, shown on Figure 2-2, enables local operator control and modification of the WJ-8969 Microwave Receiving System. Manual and automatic control is accessed through the front panel keyboard and the optical encoder tuning wheel. Status information is displayed on the front panel 24-character alphanumeric display.

2.4.1 SUMMARY OF FRONT PANEL CONTROLS, INDICATORS, AND DISPLAYS

The front panel is comprised of five sections; these sections are the audio section, the alphanumeric display section, the tuning wheel, the display indicators, and the keyboard. Table 2-1 lists the functions within each front panel section.

Table 2-1. Front Panel Controls, Indicators, and Displays

Audio Section	Audio adjustment knob Headphone jack
Tuning Wheel	Tuning Wheel
Display Indicators	Tuning indicator Tune lock COR - Carrier Operated Relay AGC - Automatic Gain Control AFC - Automatic Frequency Control REM - Remote Controlled

Table 2-1. Front Panel Controls, Indicators, and Displays - Continued

Alphanumeric Display	24-digit alphanumeric display provides: Tuned RF frequency IF bandwidth RF attenuation Detection mode COR level Signal strength AM detection % Memory cell number Error messages
Keyboard	MEM - Frequency memory examination STORE - Frequency memory storage EXEC - Configuring receiver to memory cell LKOT - Lockout to set and enable lockout channels COR Level - Carrier Operated Relay Level RF ATTN - RF Attenuation IF BW - IF Bandwidth Selection TUNE RATE - Tuning Rate Selection FREQ - Manual Tune Frequency Selection AGC - Automatic Gain Control Selection AFC - Automatic Frequency Control Selection DET MODE - Detection Mode Selection MENU - Selection of menus INC - Increment of values and functions
Functions	DEC - Decrement of values and functions MAN - Control of manual mode STEP - Control of STEP mode SCAN - Control of SCAN mode LOCAL - Toggle of remote or local control ENTER - Enters data for values or menus SHIFT - Shifts the keyboard to numeric keys and shifts functions of other keys

2.4.2 AUDIO SECTION

The audio section is comprised of an audio level adjustment knob and a corresponding 1/4-inch audio output jack. The WJ-8969 receiver provides an audio representation (stretched or unstretched video) of the received RF signals. Audio output is provided on the headphone audio jack. This output has a squelch feature that is related to the COR function.

The relationship is that if you adjust the COR level to an "- -" indication, then there is no output from the front panel PHONES connector. Note, however, that the fixed audio output, from the rear panel AUDIO connector is not affected by the squelch feature.

2.4.3 TUNING WHEEL

The tuning wheel provides one mode of control for the tuned frequency when the receiver is in the manual mode. The receiver is capable of tuning in 1 kHz synthesized frequency steps. The tuned RF frequency is displayed on the alphanumeric display. Tuning is aided by a signal centering indicator located above the tuning wheel.

Clockwise rotation of the tuning wheel increments the tuned frequency while counterclockwise rotation decrements by the chosen tuning step. One rotation of the tuning wheel accomplishes 64 increments/ decrements. The present increment/decrement most significant digit is constantly displayed as a cursor location on the frequency display. If you choose an odd increment such as 25 MHz the cursor is not displayed.

2.4.4 DISPLAY INDICATORS

The display indicators consist of LO-TUNE-HI, TUNE LOCK, COR, AGC, AFC, and REM. They assist the operator in recognizing the current status of the receiver. The TUNE LOCK indicator lights when the tuning wheel and DEC/INC keys are disabled for frequency tuning. This means that rotation of the wheel and pressing the DEC or INC keys in the Frequency mode have no effect on the tuned RF frequency. In this condition, only the numeric keypad can be used to control frequency. See paragraph 2.4.8.2., Manual Mode Operation, for details on how to implement the TUNE LOCK feature.

The AGC, AFC, REM and COR indicators are lit when their corresponding functions are active. As an example, the AGC indicator is lit when automatic gain control is selected at the keyboard. AFC, REM and COR are abbreviations for Automatic Frequency Control, Remote Control and Carrier Operated Relay, respectively. All these functions are implemented at the keyboard. The REM indicator is turned on or off via the LOCAL key and the COR indicator is lighted whenever a signal breaks the threshold level established using the COR LEVEL key.

The LO-TUNE-HI indicator shows if the tuned frequency is lower or higher than a detected RF signal. If the RF is higher, then the indicator moves towards LO; if the RF is lower, then the indicator moves

towards HI. When using this indicator, remember two things: (1) it is not dependent on the COR level setting, (2) the RF signal must be detectable by the system; that is, above the minimum discernible signal (MDS) level.

2.4.5 ALPHANUMERIC DISPLAY

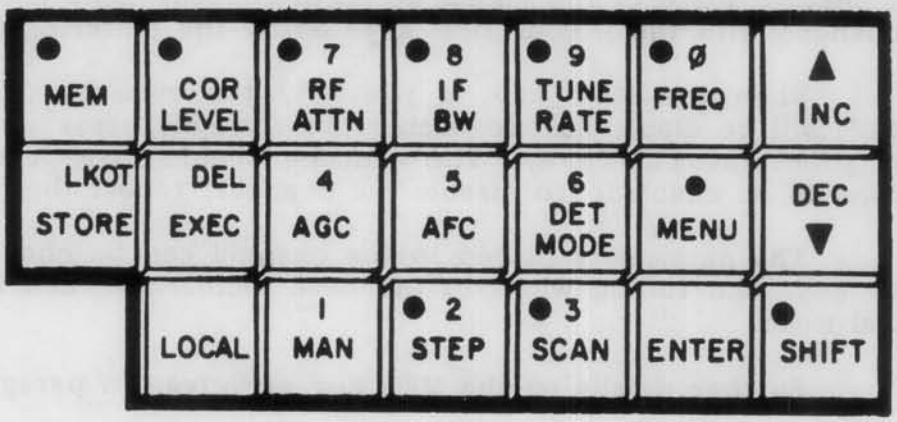
The alphanumeric display is a 24-character display showing signal strength (-dBm), detection mode, IF bandwidth, and tuned frequency. In different modes, the display may also display a memory channel number, COR level, RF attenuation, % AM detection error, messages, lockout frequencies, menu names, and other information. This display, with the display indicators, functions as the primary information source for current receiver status.

2.4.6 KEYBOARD

The WJ-8969 keyboard is the source of all local control for receiver configuration and operational modes. Figure 2-3 shows the front panel keyboard layout. The keyboard encompasses a numeric keyboard that is operational when the SHIFT function is implemented. The numeric keyboard is shown near the top edge of selected keys (numbers 0 through 9 and decimal point).

When the SHIFT key is pressed, a LED on the key is lit indicating that the shift function is enabled. Other keys on the keyboard operate in a similar manner with the LED indicators.

The decimal point on the MENU key should not be confused with LED indicators located in the upper left corner of nine keyboard keys. Two other shift function keys exist (LKOT and DEL) that are discussed in paragraphs 2.4.6.8 and 2.4.6.10.



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(86.B.7947)

Figure 2-3. Front Panel Keyboard

The keys marked INC and DEC (located in the upper right corner of the keyboard) are global function keys that allow incrementing and decrementing of certain values or functions. The INC/DEC keys employ an auto repeat function that allows automatic repeat of the function desired at a rate of 15 times per second. This feature is implemented by depressing and holding the INC or DEC key for longer than 0.5 seconds.

The ENTER key is used primarily to enter numeric values selected from the keyboard. Other functions require the entire key as a utility function key and will be specifically mentioned when discussing those functions.

Operational details on using the keys which require that an operator enter other data associated with the function of these keys are given in the description of these keys and in paragraph 2.4.8 (Operational Capabilities). These keys are:

MEM
COR LEVEL
RF ATTN
IF BW
TUNE RATE
FREQ
STORE/LKOT
MENU
STEP
SCAN

2.4.6.1 MEM Key

Pressing the MEM key lights the light on the key and places the unit in the examine memory mode. In this mode the display shows the parameters stored in the selected memory channel. The type of channel (indicated by either S for scan channels or T for step channels or L for lockout channels) and the channel number along with a flashing "*" appears in the display in place of the signal strength readout. The channel number can be changed with the INC or DEC keys or by the numeric keypads.

When the MEM key is pressed, the message "CHANNEL DISABLED" will be displayed. To enable the channel, press the SHIFT key and then press the LKOT key. The message should disappear and the channel should be enabled. To disable the channel, repeat the process.

The parameters stored in the channel can be changed with the parameter keys and tuning wheel in the same manner as when the unit is in the Manual mode.

Further details on the MEM key are given in paragraph 2.4.8.3.

2.4.6.2 COR LEVEL Key

This key activates the edit mode of the Carrier Operated Relay function. When pressed, the LED on the key indicates the edit mode is active. COR level may be set using the INC/DEC keys or by the numeric keypad. The display shows this relative level variable from 00 to 60. This feature is set in memory channels and for the manual mode. Setting this level at different values for different scan strategies allows the operator to distinguish different thresholds within the chosen passband of the receiver.

If a number greater than "60" is entered, the COR LVL display shows "--" and the COR LEVEL keys light and function is turned off.

2.4.6.3 RF ATTN Key

This key activates the edit mode of the RF attenuation function. When pressed, the LED on the key indicates the edit mode is active. RF attenuation levels may be set using the INC/DEC keys or by the numeric keys. The display shows attenuation level (in 1 dBm increments) in place of IF BW in the alphanumeric display and is variable from 00 to 99. The AGC function must be off to edit the RF ATTN function.

This feature can be set in memory channels and for the manual modes. Setting this level at different values for different scan strategies allows the system to operate under varying conditions of RF energy levels. In hardware, this feature adjusts the variable attenuators in the IFC.

2.4.6.4 IF BW Key

This key activates the edit mode of the IF bandwidth selection function. When pressed, the LED on the key indicates the edit mode is active. IF bandwidths may be selected using the INC/DEC keys. The system will cycle through the possible choices of IF bandwidth (up through the possible choices of IF bandwidth) reflecting those bandwidths (up to eight) that are installed. The current selection is shown in the alphanumeric display.

This function may be set in memory channels and for the manual mode. Selection of IF bandwidth allows particular intercept capability for varying signals, both narrowband and wideband; this creates very flexible analysis and capture capabilities for the operator.

2.4.6.5 TUNE RATE Key

This key activates the edit mode of the variable tune rate function. When pressed the LED on the key indicates the edit mode is active. The tuning rate may be selected using the INC/DEC keys, or numeric keys. Any tuning rate may be selected between 1 kHz and 1 GHz. A cursor in the alphanumeric display shows the current most significant digit of the tune rate chosen.

After a tuning rate has been selected, the tuning wheel or INC/DEC keys will change the tuned frequency (in the frequency mode) by the selected increment. This feature allows the operator to tune using desired steps for particular intercept applications and adjustable fine and coarse tuning. This function is especially helpful when the auto repeat function of the INC/DEC keys is implemented, allowing discrete stepping without using memory channels.

One position of the tune rate is Tune Lock. This is indicated by the Tune Lock lamp near the tuning wheel. When this choice is implemented, the tuning wheel and INC/DEC keys have no effect on the tuned frequency. Only a discrete frequency input from the numeric keyboard can change the tuned frequency. See paragraph 2.4.8.2 (Manual Mode Operations) for details on using the Tune Lock feature.

2.4.6.6 FREQ Key

This key activates the tuned frequency mode of the receiver. When pressed, the LED on the key indicates this mode is active. The tuned frequency may be adjusted using the numeric keys, the tuning wheel, or the INC/DEC keys. This function works in conjunction with the Tune Rate setting. The tuned frequency is always displayed in the alphanumeric display in MHz with a resolution down to 1 kHz.

2.4.6.7 STORE Key

This key initiates a store operation to be executed with the current memory channel number. Pressing the key displays the message "ENTR TO STORE MEMORY" along with the current memory channel. Selection of the channel number is through the INC/DEC keys or the numeric keypad. It allows storage of newly selected parameters into a selected memory channel. No data, however, is stored until the ENTER key is also pressed.

2.4.6.8 LKOT Key

The main function of this key is to enable an operator to lockout selectable frequencies of range of frequencies so that the receiver does not intercept or process them. This is done by designating certain memory channels as "lockout channels." These memory channels are identified by the letter "L" preceding the channel number.

To lockout a specific frequency, the frequency and an associated IF bandwidth filter (other than "bypass") is selected. The lockout frequency range for this specific frequency is then f-1/2 BW to f+1/2 BW. To lockout a range of frequencies, the Start frequency and Stop frequency are entered.

The following is an example of how frequencies can be locked out using the LKOT key. Details of using the key to accomplish lockout follows this example and describes the three lockout states.

Assume that you are using memory channels L60 through L67 for lockout and that you have entered the following by using the LKOT key:

Channel L60: 1000 MHz, any IF BW
Channel L61: 1500 MHz to 2000 MHz
Channel L62: 2500 MHz, any IF BW
Channel L63: 3000 MHz to 4000 MHz
Channel L64: 4500 MHz, any IF BW
Channel L65: 5000 MHz to 8000 MHz
Channel L66: 9000 MHz, any IF BW
Channel L67: 10000 MHz to 12400 MHz

For channels 60, 62, 64, and 66, the receiver will not intercept signals at the lockout frequency ±1/2 the IF BW selected. For channels 61, 63, 65, and 67, the receiver will not intercept signals between the two lockout frequencies.

Use of the key to accomplish the lockout feature using a selected frequency and bandwidth is as follows:

a. Press the SHIFT key and then the LKOT key. The front panel display will present the message "ENT-TO LO" along with an IF BW value and FREQUENCY MHz value. In this first lockout state, the lockout frequency and IF bandwidth is entered. The lockout frequency can be entered by the tuning wheel or by the numeric keypad. The IF BW can be changed by using the INC or DEC keys.

b. Press ENTER key. The frequency and IF bandwidth are now stored in the next available lockout channel. Use the MEM key to ensure that this data has been stored correctly. For example, If the last lockout channel was L69, then the data you just entered should be stored in channel L70. Remember that you can step through the S (scan), T (step), and L (lockout) channels, after MEM key is pressed, by using the INC and DEC keys.

Use of the key to accomplish the lockout feature using a selected start and stop frequency is as follows:

a. Press the SHIFT key and then the LKOT key. The front panel display will present the message "ENT-TO LO" along with an IF BW value and FREQUENCY MHz value. In this first lockout state, however, you need the second and third lockout states to enter start and stop frequencies. So proceed with the following steps.

b. Press the SHIFT key and then the LKOT key again. The message "LO START FREQ" will be displayed along with a default frequency value. This is the second lockout state. Enter your starting frequency through the tuning wheel, INC or DEC keys, or via the numeric keypad.

c. Press ENTER key. The message "LO STOP FREQ" will be displayed along with a default frequency value. This is the third lockout state. Enter your stopping frequency through the tuning wheel, INC or DEC keys, or via the numeric keypad.

d. Press the ENTER key. The unit should return to the manual mode and the display should present the current parameters of your manual mode. The start and stop frequencies are now stored in the next available lockout channel. Use the MEM key to ensure that this data has been stored correctly. For example, if the last lockout channel was L70, then the data you just entered should be stored in channel L71. Remember that you can step through the S (scan), T (step), and L (lockout) channels, after MEM key is pressed, by using the INC and DEC keys.

Initially, the lockout channels are set for channels 60 through 99 (and are identified by the letter "L"). However, these may be changed to other channels by using the Configuration Menu (press the MENU key) and selecting the FIRST LOCKOUT CHANNEL prompt.

Another function of the LKOT key is to enable or disable a memory channel. If a memory channel is disabled,a flashing "CHANNEL DISABLED" message will appear on the display after the MEM key is pressed and a channel is selected that is currently disabled. To enable a desired channel, press the SHIFT and then the LKOT keys. The message will disappear and the channel will be enabled. To disable an already enabled channel, press the SHIFT and then the LKOT keys. The flashing "CHANNEL DISABLED" message will appear and the channel will be disabled.

2.4.6.9 EXEC Key

This key works with the MEM key. When the MEM key is pressed (and lighted), pressing the EXEC key changes the unit's parameters to those stored in the selected memory channel and sets the IFC unit to the Manual mode.

2.4.6.10 DEL Key

This key is the shifted function of the EXEC key and acts as a correction key for the numeric keypad. In the shift mode, the numeric keys are active for setting frequency, RF attenuation, COR level, etc., and the DEL key simply cancels the last action for corrections. The key may be pressed as many times as necessary to make the correction. Commands are not executed until the ENTER key is pressed.

2.4.6.11 AGC Key

This key toggles the automatic gain control function of the receiver. The display indicator marked AGC lights when AGC is active. AGC may be implemented in memory mode and the manual mode. Automatic gain control is useful to the operator to maintain the desired signal levels (required for signal-to-baseband video demodulation) within the linear region of the detector circuits.

2.4.6.12 AFC Key

This key toggles the automatic frequency control function of the receiver. The display indicator marked AFC lights when AFC is active. AFC may be implemented in memory and the manual modes. Automatic frequency control is useful to the operator to maintain an unstable RF signal within the receiving passband.

2.4.6.13 DET MODE Key

This key causes the receiver to cycle through the possible detection modes of the receiver. The alphanumeric display indicates the selected mode (AM, FM, CW and pulse). This mode may be implemented in memory mode and the manual mode. CW is only implemented when the optional 21.4 MHz IF module is installed (Option AA).

The detection modes enhance the receiver's capability to intercept particular signals and allow the operator to capture and identify many types of RF signals.

This key also incorporates an auto-repeat function that cycles through all detection modes at a rate of two times per second. This mode is entered by pressing and holding the key down for 0.5 seconds.

2.4.6.14 MENU Key

This key initiates the selection of the various menus of the receiver. Pressing this key displays the name of the first sub-menu. The INC/DEC keys display other sub-menus. ENTER causes the currently selected sub-menu to initiate the prompts of that menu. There are five sub-menus:

1. SCAN SEGMENT Sub-Menu

   This menu provides a means of entering the information in a scan memory channel by answering a series of questions. This information may also be entered by setting the receiver parameters and using the STORE key. Another way of entering the same information is to use the MEM key and use the appropriate keys to change existing data or to enter new data.

A new or occasional operator will benefit from this menu driven approach. Each prompt displays the name and current value of a parameter. The value may be saved unchanged with the ENTER key or may be changed with the keys in the usual manner for that particular parameter. The parameters are displayed in sequence.

The prompts are:

(1) CHANNEL NUMBER
(2) START FREQ
(3) STOP FREQ
(4) IF BANDWIDTH
(5) DETECTOR MODE
(6) COR LEVEL
(7) AGC OPTION
(8) AFC OPTION

2. SCAN/STEP OPTIONS Sub-Menu

This menu allows the operator to determine the action taken by the receiver when a signal is found while scanning or stepping. Each prompt displays the name of an option and a YES or NO indicating the current status of the option. The INC key sets the option to YES while the DEC key sets it to NO. The enter key leaves the answer unchanged and the next option is displayed.

The prompts are:

(1) MULTI SEQUENCE SCAN
(2) QUEUE SIG-DONT STOP
(3) HOLD AFTER SIG GONE
(4) HOLD AFTER ONE PASS
(5) DETECT LEADEDGE ONLY
(6) HOLD IF QUEUE FULL
(7) HALF BW SCAN
(8) FULL BW SCAN
(9) SCAN INCREMENT

3. CONFIGURATION Sub-Menu

This menu displays the configuration parameter's names and current values. Each parameter may be changed with the INC/DEC or numeric keys. The parameters are the first step channel, the first lockout channel, the remote interface address, and any parameters associated with installed options.

The prompts are :

(1) FIRST STEP CHANNEL
(2) FIRST LOCKOUT CHANNEL
(3) REMOTE INTERFACE ADDR

4. ERROR DISPLAY Sub-Menu

Unless disabled, error messages are displayed on the alphanumeric display when associated errors occur. This menu is a convenient way to reexamine these messages.

The prompts are:

(1) ENABLE TUNER ERRORS
(2) ENBL HARDWARE ERRORS
(3) HARDWARE ERRORS FOLLOW

5. FREQUENCY QUEUE Sub-Menu

This menu allows the operator to display the frequencies intercepted in the Scan or Step mode. Sixteen frequencies can be stored and once the frequencies are displayed they will be erased from memory.

2.4.6.15 LOCAL Key

This key toggles the system operation between remote operation and local control. When the system is in remote control the display indicator marked REM lights to show that remote operation is activated. The remote address is set in the configuration sub-menu and remote control can only be accomplished if an interface has been installed in the IFC unit.

All front panel functions are available by remote control and the keyboard is locked to prevent conflicts. When the LOCAL key is pressed again, control returns to the keyboard and the REM indicator is extinguished.

All display information is maintained while in the remote mode for local status information.

2.4.6.16 MAN Key

This key activates the manual mode of operation when the receiver is in automatic mode. The manual key allows changing of the mode from SCAN/STEP to the Scan-pause or Step-pause modes. In these modes, receiver parameters may be changed. If the MAN key is pressed twice the receiver returns to the complete manual mode. If another control selection is pressed (STEP, SCAN) then the receiver resumes the prior configuration. This feature allows easy manipulation of current automatic modes for quick reaction or change of control.

2.4.6.17 STEP Key

When the STEP key is pressed, it lights the light on the key and puts the unit in step-armed state. The message "ENTER TO START STEP" is displayed along with the current channel number with a flashing "*". The channel number may be changed with the INC or DEC keys or by the numeric keypads and must be put into a valid step channel.

If the ENTER key is pressed while in this state, the STEP key remains lit and the unit starts stepping from the first step channel through all enabled step channels up to the selected step channel. When stepping, the unit sets itself to the parameters stored in the step channels. In this mode, the display shows the message "STEPPING."

While the unit is stepping and the MAN key is pressed, the unit goes to step-pause state. The STEP key light flashes on and off and the unit's parameters can be changed in this state. If the MAN key is pressed again, the STEP key light will turn off and the unit will return to Manual mode.

Initially, the step channels are set for 30 through 59 (identified by a letter designation of T), but these may be changed to other channels through the Configuration Menu. The step channel parameters may be entered using the STORE key or they can be entered through the Scan Segment Menu. The type of step desired can be set through the Scan/Step Options Menu.

2.4.6.18 SCAN Key

When the SCAN key is pressed, it lights the light on the key and puts the unit in scan-armed state. The message "ENTER TO START SCAN" is displayed along with the current memory channel number with a flashing "*". The channel number may be changed with the INC or DEC keys or by the numeric keypads.

If the ENTER key is pressed while in this state, the SCAN key remains lighted and the unit starts scanning from the frequency in the selected memory channel to the frequency in the next higher numbered channel. In this state, the display shows the start frequency, the message "SCAN", and the stop frequency. If Multi Sequence Scan is enabled in the Configuration Menu, the unit will scan from the first scan memory channel to the memory channel selected. The display will show "SCAN" and the start and stop frequency currently being scanned.

While the unit is scanning and the MAN key is pressed, the unit goes to scan-pause state. The SCAN key light flashes on and off and the unit's parameters can be changed in this state. If the MAN key is pressed again, the SCAN key light will turn off and the unit will return to the Manual mode. If the SCAN key is pressed instead of the MAN key, the the unit will continue scanning.

Initially, the scan channels are set for 00 through 29 (identified by a letter designation of S) but these may be changed to other channels through the Configuration Menu. The scan channel parameters may be entered manually or they can be entered through the Scan Segment Menu. The type of scan desired can be set through the Scan/Step Options Menu.

2.4.7 POWER ON SWITCH

This switch controls the application of ac and dc power applied throughout the unit.

2.4.8 OPERATIONAL CAPABILITIES

The WJ-8969 system generally operates in one of four modes: Manual, Step, Scan or Lockout. All operation is accomplished at the front panel of the IFC or over the remote interface. The following describes, in general, the overall operation of the receiver and highlight some of the operational flexibility available.

2.4.8.1 Power-On Operation

When the WJ-8969 is initially powered-up, it runs a self-test to check for any faults in the system. This feature allows for easy troubleshooting or maintenance that may be needed. Error messages are displayed in the IFC unit's alphanumeric display describing any errors that may be present. These error messages include first and second local oscillator lock status, tuner control status and many others. The message reporting may be cancelled if undesired. Receiver operation will continue on a limited basis depending on the error message.

Also during power-on, the receiver runs a calibration mode that sets IF gain. This is accomplished by sending an internal signal of known amplitude over the interconnecting cable and through the detectors. After all error checking and calibration is complete, the receiver enters the Manual mode of operation. The receiver continues to check for internal system errors while in operation. The total power-on sequence takes about five seconds.

2.4.8.2 Manual Mode Operation

The receiver's default state of operation is the Manual mode. In this mode, the operator may tune the desired frequency by pressing the FREQ key and manipulating the tuning wheel or the INC/DEC keys, changing the frequency by an increment determined using the TUNE RATE key. This increment can range from 1 kHz to 1 GHz. Frequency may also be input discretely by keypad input.

After the desired frequency is determined, a number of different operations can occur. The operator may choose the detection mode desired (AM, FM, CW or Pulse), set AFC or AGC on or off, select IF bandwidth and set RF attenuation and carrier operated relay (COR) levels according to the mission requirements.

2.4.8.2.1 Disabling Tuning Wheel

The tuning wheel may be disabled in the manual mode to prevent accidental rotations. To do this, press the TUNE RATE key and then use the INC or DEC key to set all digits to zero. The TUNE LOCK indicator will then light and there will be no blinking cursor ("*") in the "FREQUENCY MHZ" display. Depress the TUNE RATE key to return to normal operation.

2.4.8.2.2 Clearing Memory Channels

Data stored in the memory channels can also be erased and cleared in this operation mode. This is a desirable feature if an operator wants certain receiver mission parameters to be protected from unauthorized personnel. The IFC unit contains a battery pack to save memory contents when the unit is turned off, so an operator must clear memory.

The "Clear Memory" function is implemented as follows:

1. Turn off the unit.
2. Hold down DEL/EXEC key while turning on power to the unit. The unit will power-up as normal but the first message will be "POWER-UP MEMORY CLEAR ON."
3. Verify that data stored in the various memory channels has been cleared by using the MEM key and examining the contents of memory channels in which data had been entered previously. All such data should be cleared.

Another way to clear memory channels is to:

1. Enter the Configuration Sub-Menu (by using the MENU key).
2. Use the INC or DEC key until "CONFIGURATION MENU" appears on the display.
3. Press the ENTER key and then change a parameter.
4. Press the MENU key.
5. "CLEARING MEMORY" will appear on the display, indicating that all data entered into memory channels has been cleared.
6. Verify that data stored in the various memory channels has been cleared by using the MEM key and examining the contents of memory channels in which data had been entered previously. All such data should be cleared.

2.4.8.3 Step, Scan Lockout Modes of Operation

2.4.8.3.1 General

The internal memory of the WJ-8969 receiver maintains up to 256 cells of receiver information. Each cell can be designated as a Scan, Step, or Lockout channel. Scan and Step channels contain an entire receiver configuration (frequency, IF bandwidth, RF attenuation, detection mode, COR threshold, AGC, and AFC).

A Scan segment consists of a start frequency, bandwidth, attenuation, COR, AGC, and AFC in an even memory channel and the stop frequency in the next higher memory channel. When a Scan operation is initiated, the receiver will scan from the selected memory channel using its frequency as start frequency (and all of its receiver parameters) and scan up to the frequency in the next memory channel at the scan step rate selected by the operator in the Scan/Step Options Menu. The scan step size can be half IF bandwidth steps, full IF bandwidth steps, or a defined step size between 1 kHz and 100 MHz. If multisequence Scan is selected, the receiver will scan channels 0 to 1, 2 to 3, 4 to 5, ..., up to the selected memory channel pair.

Step channels consist of discrete frequencies and receiver parameters in one channel. When a Step function is initiated, the receiver will step-tune through all the enabled Step channels from the first Step channel to the operator selected memory channel, skipping those channels which are disabled.

There is a third type of memory channel called Lockout. A Scan Lockout is a frequency range in which no signal detection will occur. A Lockout can be either an IF bandwidth centered on a discrete frequency or it can be the region between operator selected start and stop frequencies. During Scan or Step operations, the receiver will not check for signals while the tuner is tuned to frequencies in the Lockout channels.

2.4.8.3.2 Memory Cells

There are 256 memory cells within the WJ-8969 receiver. These cells can be accessed through both the front panel and the IEEE-488 interface port. Due to display limitations, only the first 100 cells (0 through 99) are accessible through the front panel. However, the full 256 memory cells may be accessed through the remote interface.

2.4.8.3.3 Partitioning the Memory Cells

While the WJ-8969 receiver contains 256 memory cells, these memory cells are shared by the Scan, Step, and Lockout functions. To enable more efficient use of the receiver memory cells, the operator is given the capability to program and allocate the memory cells for the Scan, Step, and Lockout functions.

The partitioning or allocation of memory cells is accomplished via the Configuration Menu. To access the Configuration Menu, depress the Menu key. The receiver will display "SCAN SEGMENT MENU". Depress the INC key twice to get the Configuration Menu. Depress the ENTER key to enter the configuration function. The receiver display will show the message "FIRST STEP CHANNEL n" where n is the first Step channel. The receiver default value for n is 30. This defines channels 0 through 29 as Scan channels. These channels define 15 scan sector regions (the even channels give start frequencies and the odd channels give the stop frequencies.

To adjust the memory allocation of Scan channels, depress the INC or DEC keys to change the first Step channel to the desired value (or use the SHIFT key, Numeric keys, and ENTER key to enter the desired value). When the correct value is shown, depress the ENTER key.

The receiver will now display "FIRST LOCKOUT CHANNEL n" where n is the first Lockout channel. The receiver default value for n is 60. This defines (using default of 30 as first step channel) channels 30 through 59 as Step channels. The operator can change the allocation of Step channels using the INC or DEC keys or the SHIFT-Numeric-ENTER keys. Once the desired value is shown, depress the ENTER key.

To exit the Configuration Menu, depress the MENU key. If any change was made in memory allocation, the message "CLEARING MEMORY" will appear.

The memory allocation can also be changed via the IEEE-488 using the command PAR n,m where n is first Step channel and m is first Lockout channel. Any change in configuration from Menu or IEEE-488 will clear all memory cells.

2.4.8.3.4 Programming Scan Channels

The operator can program the desired Scan channels in several ways. The first method is done in Memory Examine mode. To enter Memory Examine mode depress the MEM key. Use the INC or DEC keys or the SHIFT key followed by the desired channel number to change the channel number on the display. The channel number is displayed on the far left side of the front panel display.

Scan channel numbers are preceded by S, Step channel numbers are preceded by T, and Lockouts are preceded by L. While in Examine mode, the operator can change any parameter of the cell using the front panel keyboard and tuning wheel.

While in Memory Examine mode, the front panel keys effect only memory channel parameters and do not affect the receiver configuration. When exiting Memory Examine mode or changing channels, all parameters entered for the memory channel are saved. When memory is cleared, the message "CHANNEL DISABLED" will flash on the display. To enable (or disable) a channel, depress the SHIFT key and then the LKOT key while in Examine mode. The SHIFT-LKOT is an enable/disable toggle.

The operator can also use the Scan Segment Menu to program a Scan channel. This menu provides a means of entering the information for a Scan channel by responding to a series of questions. Each question prompts the operator via the receiver display. Each prompt gives the parameter and its current value. The value can be changed with the front panel keys and the value (changed or unchanged) is saved by depressing the ENTER key. The prompts are shown below:

CHANNEL NUMBER	The channel number shown is the start frequency channel. It can be changed with INC, DEC, or SHIFT-Numeric-ENTER
START FREQUENCY	Can be changed with Tuning Wheel or SHIFT-Numeric-ENTER. The INC and DEC keys change tune rate.
STOP FREQUENCY	Same as START FREQUENCY
IF BANDWIDTH	Can be changed using INC or DEC keys
DETECTION MODE	Can be changed using the DET key
COR LEVEL	Can be changed using INC, DEC, or the SHIFT-Numeric-ENTER keys
AGC	INC = YES, DEC = NO
AFC	INC = YES, DEC = NO

The operator can also program a Scan channel by setting up receiver parameters in Manual mode using the front panel pushbuttons and tuning wheel and then depressing the STORE key. The display will prompt the operator with "xx ENTER TO STORE" where xx is the channel the receiver parameters will be stored in. Before pushing ENTER, this value can be changed to the desired value using the INC, DEC, or SHIFT-Numeric-ENTER keys. When ENTER is pressed, the receiver parameters are stored in the selected SCAN channel.

Scan channels can be programmed via the IEEE-488 interface port as well. The command "RCE n" where n is channel number will put the receiver in Memory Examine mode. In this mode, all parameter commands such as "COR n", "FRQ f", "BW n", "RFG n", "AM", "FM", "PLS", etc., will set memory channel parameters.

Another way to program SCAN channels via IEEE-488 is to use the command "SCH mch,enb,frq,bw,cor,det,afc,agc,rfg" to set all parameters with one command. Any parameters omitted (keep commas) will be unchanged. For example, "SCH 2,ENB,200).5,,,PLS,,AGC/," will enable memory channel 2, change the frequency to 2000.5, change to Pulse detection mode and turn off the AGC. All other parameters will not be changed in this example.

Note that the only way to program a scan step size is via the SCAN/STEP OPTIONS MENU as described in paragraph 2.4.8.3.7.

2.4.8.3.5 Programming Step Channels

The operator can program the desired Step channels in several ways. The first method is done in Memory Examine mode. To enter Memory Examine mode depress the MEM key. Use the INC or DEC keys to change the channel number on the display. The channel number is displayed on the far left side of the front panel display. Scan channel numbers are preceded by S, Step channel numbers are preceded by T, and Lockouts are preceded by L.

While in Examine mode, the operator can change any parameter of the cell using the front panel keyboard and tuning wheel. While in Memory Examine mode, the front panel keys effect only memory channel parameters and do not affect the receiver configuration. When existing Memory Examine mode or changing channels in Examine mode, all parameters entered for the memory channel are saved.

In Step mode, a memory channel can be disabled or enabled. To toggle the status of a channel, while in Examine Memory mode, depress the SHIFT key, then the LKOT key. All channels default to a disabled state.

The operator can also program a Step channel by setting up receiver parameters in Manual mode using the front panel pushbuttons and tuning wheel and then depressing the STORE key. The display will prompt the operator with "xx ENTER TO STORE" where xx is the channel the receiver parameters will be stored in. Before pushing ENTER, this value can be changed to the desired value using the INC, DEC, or SHIFT-Numeric-ENTER keys. When Enter is pushed, the receiver parameters are stored in the selected Step channel.

Step channels can be programmed via the IEEE-488 interface port as well. The command "RCE n" where n is channel number will put the receiver in MEMORY EXAMINE mode. In this mode, all parameter commands such as "COR n", FRQ f", "BW n", "RFG n", "AM", "FM", "PLS", etc., will set memory channel parameters.

Another way to program Step channels via the IEEE-488 is to use the command "SCH mch,enb,frq,bw,cor,det,afc,agc,rfg" to set all parameters with one command. Any parameters omitted (keep commas) will be unchanged. See example in paragraph 2.4.8.3.4.

2.4.8.3.6 Programming Lockout Channels

To program a Lockout frequency, depress the SHIFT then the LKOT keys. The receiver will display "ENT-TO LO" with the current IF bandwidth and tuned frequency. The bandwidth can be changed using the tuning wheel. When the desired frequency and bandwidth are obtained, the information can be saved by depressing the ENTER key. The Lockout data is stored in the first available Lockout channel allocated in memory.

To program a Lockout range, depress the SHIFT then the LKOT keys, then depress them again. The receiver will respond with "LO START FREQ" and the frequency which can be changed with the tuning wheel or the SHIFT-Numeric-ENTER keys. When the desired Lockout start frequency is obtained, it can be saved by depressing the ENTER key.

Once ENTER has been depressed, the receiver will display "LO STOP FREQ" and a frequency (equal to start frequency) which can be changed with the tuning wheel. Once the desired stop frequency is obtained, depressing ENTER will save the stop frequency and the display will return to normal operating mode.

Lockout frequencies can also be entered via the IEEE-488 using the "LKF freq, bw" command (where freq = Lockout frequency and bw = IF bandwidth centered about the frequency). Also, the command "LCK" will set up a Lockout channel using the current tuned frequency and the current IF bandwidth. Lockout ranges can be entered via IEEE-488 by using the "LKR f1,f2" command.

When a SCAN function is initiated, the receiver will rearrange the Lockout channels in order of increasing start frequency. For range type LOCKOUTs, the start frequency is given. For frequency-bandwidth type LOCKOUTs, the start frequency is calculated as FREQ - 1/2 BW. The Lockout with lowest start frequency will be in the first channel allocated to Lockouts.

Once Lockout channels are programmed into memory, they can be displayed and modified in Memory Examine mode. Only programmed Lockout channels are accessible in Examine mode. Default value for the first Lockout channel is 60. A Lockout channel is added in the lowest available channel above the currently existing Lockout channels.

To Examine a Lockout channel, depress the MEM key, then depress INC, DEC, or SHIFT-Numeric-ENTER keys until the desired Lockout channel is displayed. Depressing ENTER will put the receiver in Examine mode.

For frequency-bandwidth type Lockout channels, the frequency can be modified by depressing the FREQ key and then using the tuning wheel or the INC and DEC keys. The bandwidth can be modified by depressing the BW key and then using the INC or DEC keys.

Start-stop frequency type Lockouts will be shown in two parts; the start frequency on one display and then the stop frequency on another. To move between the two displays use the INC or DEC keys. The channel number will be the same for both the start freq and the stop freq displays. The frequencies can be modified by depressing the FREQ key and then using the tuning wheel or the INC and DEC keys.

2.4.8.3.7 Scan and Stop Options

There are several options available for Scan operations, some of which also apply to Step operations. These options can be selected by using the Scan/Step Options Menu. To enter this menu, depress the MENU key and then depress the INC key once. The receiver will display "SCAN/STEP OPTIONS MENU". Depress the ENTER key to enter this menu function. The receiver will prompt the operator with several questions via the display. The prompts are listed below along with power up default values:

MULTI SEQUENCE SCAN	no	INC = yes, DEC = no. If yes, the receiver will Scan 0-1,2-3,4-5,...,up to the selected memory channel pair. If no, the receiver will scan only one segment from the selected memory channel to the next channel.
QUEUE SIG-DONT STOP	no	INC = yes, DEC = no. If yes, both Scan and Step will not stop in a signal that breaks threshold, but put it in the 16 frequency queues. If no, both operations will stop on any signal that is above the scan/stop COR threshold.
HOLD AFTER SIGNAL GONE	no	INC=yes, DEC = no. If yes, the Scan operation will stop on the first scan frequency that a signal does not break threshold when a signal has broken threshold on the previous scan frequency. The way this option works is that after a signal has stopped breaking the COR level threshold, the receiver stops scanning/stepping. This command has priority over the "Queue Signal - Don't Stop" option.
HOLD AFTER ONE PASS	no	INC = yes, DEC = no. If yes, both SCAN and STEP will stop at the last channel to be included in the sequence. If no, the receiver will wrap around and perform the sequence over and over.
DETECT LEADING EDGE ONLY	no	INC = yes, DEC = no. If yes, the SCAN operation will stop on or queue only the frequency that first broke threshold. It will not stop or queue again until after a scan step does not detect a signal above threshold. If no, then SCAN will stop on or queue every frequency that breaks threshold.

DETECT LEADING EDGE ONLY (continued)

This option enables the receiver to respond only when a signal first breaks the COR level threshold while scanning. An example of how this option can be used is as follows:

Assume that you do not want to stop on a signal in scan but to store the signal frequencies in the frequency queue. If this option is not enabled ("no"), then it is possible that as the receiver scans across one signal all 16 memory cells in the frequency queue will become filled with the tuned frequencies where that one signal broke the COR level threshold.

Assume that the option is enabled ("yes"). For this case, only one memory cell will store the tuned frequency where the signal first broke the COR level threshold. As this same signal continues to break the COR level threshold, the receiver will not store these frequencies. This means that the next time a signal is stored in the frequency queue will be when a signal first breaks the COR level threshold again.

If the receiver is scanning and is set to stop on a detected signal, then when it detects a signal, it will stop and be in the "scan pause" mode. If this option is not enabled, then when the receiver is commanded to continue scanning, it will immediately detect and stop on that same signal if it is still above the COR level threshold.

If this option is enabled, then after the receiver has stopped on a signal and then is commanded to continue, the receiver will not stop until a signal once again first breaks the COR level threshold.

HOLD IF QUEUE FULL no INC = yes, DEC = no. If yes, Scan or Step will stop if it tries to queue the 17th frequency. The queue is cleared by reading it either from Freq Queue Menu or the IEEE-488 "QUE?" command. If no, frequencies are simply not queued if no room is left in the queue.

HALF BANDWIDTH SCAN	no	INC = yes, DEC = no. These affect the
FULL BANDWIDTH SCAN	no	Scan step size.
SCAN INCREMENT	f	f is the scan step size and can be from 1 kHz to 100 MHz. This value is only used if not in Half or Full BW scan. Default on power up is 1 MHz.

Scan/Step options can also be selected via the IEEE-488 by using the command "SSO n" where n is the bit wait answer to above question.

A bit of 1 is a yes, 0 is no. The following is the bit wait for each option:

MULTI SEQUENCE SCAN	1
QUEUE SIG-DONT STOP	2
HOLD AFTER SIGNAL GONE	4
HOLD AFTER ONE PASS	8
DETECT LEADING EDGE ONLY	16
HOLD IF QUEUE FULL	32

Half BW and Full BW and Scan Increment are set using "HBW", "HBW/", "FBW", "FBW/", "SCIf" commands.

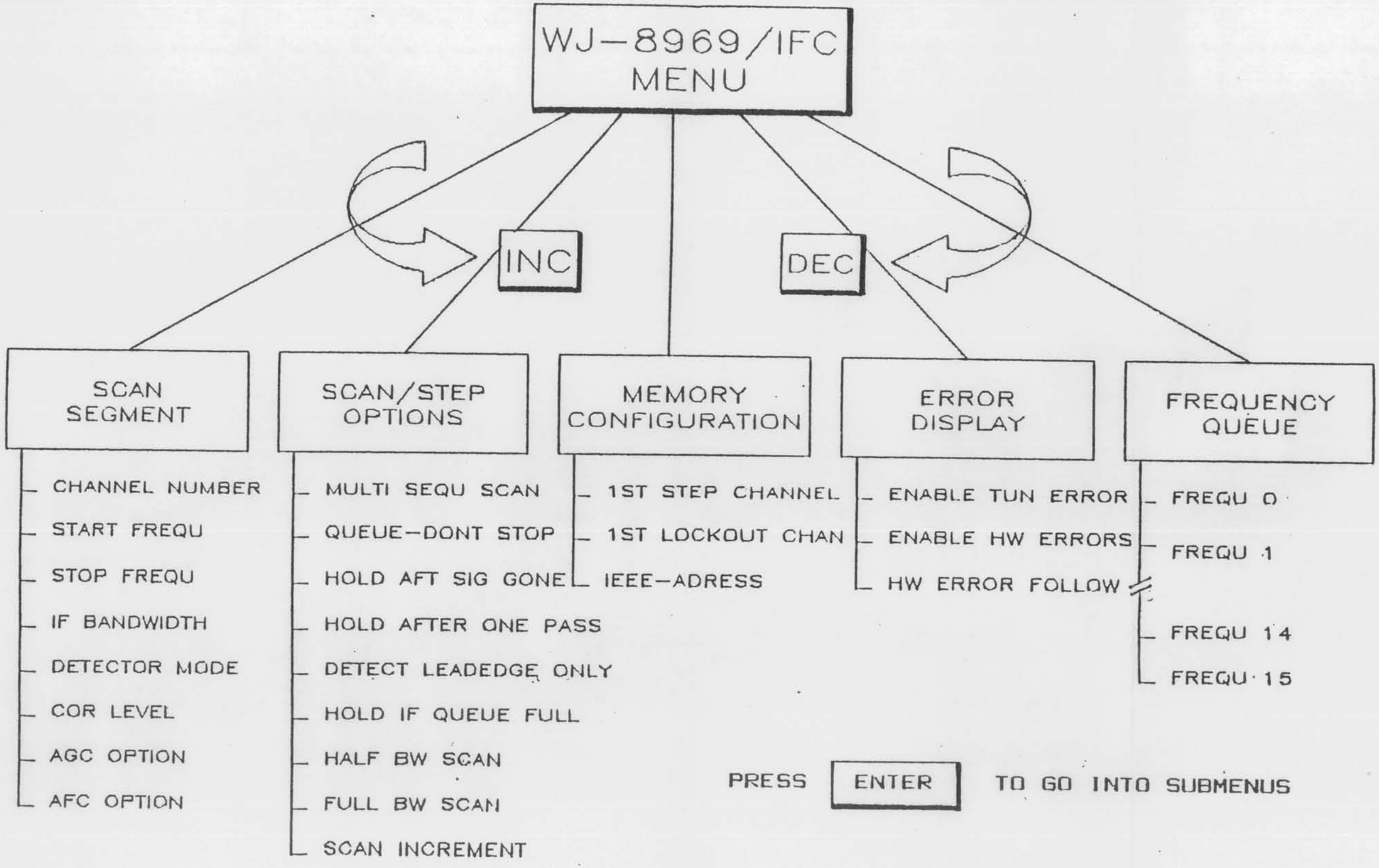
2.4.8.3.8 Initiating a Scan or Step Operation

To start a Scan operation, depress the SCAN key. The receiver will respond with "xx ENTER TO START SCAN" where xx is the selected memory channel. This can be changed using INC, DEC, or SHIFT-Numeric-ENTER keys. Once ENTER is depressed, the receiver will start scanning. If Multi-Sequence Scan is selected, it will scan 0-1, 2-3, up to selected memory pair. If Multi-Sequence Scan is not selected, it will scan from the enter channel number to the next channel.

When the receiver stops a scan due to signal detection or other options, it will resume scanning from the same point by depressing the blinking SCAN key key. Depressing the MAN key during Scan will stop the scan. Depressing MAN again will put the receiver in MAN mode, depressing SCAN will resume the Scan.

Scan operation can be initiated with the IEEE-488 "SCN n" where n is the selected channel number. It can be stopped during Scan operation with "PSE" or "MAN" commands. From the stopped condition, it can be resumed with "SCN" or returned to Manual mode with "MAN".

To start a Step, first enable and disable the appropriate Step channels (in Memory Examine mode using SHIFT-LKOT keys toggles the enable/disable status of the selected memory channel). Depress the STEP key. The receiver display will show "xx ENTER TO START STEP" where xx is the selected channel. This can be changed using INC, DEC, or the SHIFT-Numeric-ENTER keys.



Once enter is depressed, the receiver will start stepping. It will step all enabled channels from the first Step channel up to and including the selected memory channel. When the receiver stops due to signal detection or a menu option, it can resume stepping by depressing the blinking STEP key. Depressing MAN while in Step mode will stop the Step operation. Depressing MAN again will put the receiver in Manual mode, depressing STEP will resume the Step operation.

The Step operation can be initiated with the IEEE-488 "STP n" where n is the selected channel number. It can be stopped during Step operation with "PSE" or "MAN" commands. From the stopped condition, it can be resumed with "STP" or return to Manual mode with "MAN". IEEE-488 commands "CHN n" and "CHN/ n" enable and disable STEP channels, respectively.

2.4.8.4 Remote Interface/IEEE-488 Bus

Table 2-2 lists and describes the commands that enable a user to control the system via the IEEE-488 bus. The Remote Mode can be entered when the LOCAL pushbutton has been pressed to place the system in the REM (remote mode). The REM indicator lights when the system is in the remote mode.

The Remote Mode can also be entered by sending the RMT command to the IFC unit. Whether in the Remote or Local Mode, the IFC unit will respond to all "query type" commands (commands that end in ?). When the IFC unit is in the Local Mode, all IEEE-488 "active type" commands produce a "NOT IN REMOTE" error message on the front panel display and are ignored. The exception is the RMT command which places the IFC unit in the Remote Mode.

The user should be familiar with the ANSI/IEEE Std 488-1978 before using the remote interface. While detailed knowledge is not essential, the user should have a working knowledge of typical bus communications and the terminology used with the IEEE-488. Some of the typical terminology is reviewed briefly at the end of this sub-section.

2.4.8.4.1 Talking to the WJ-8969 Interface

The following highlights important details for talking to the WJ-8969 interface:

All information is placed in a RAM queue with pointers. A <LF> is a valid terminator with or without an EOI. Between multiple commands in one string, use <;> as a terminator. When a command includes several data parameters, a <,> is the delimiter between parameters.

Simply aborting an instruction/command is satisfactory since the software in the IFC unit has a built-in timeout and will abort the input routine and clear the input queue.

Extra data or characters may or may not be ignored. They may generate an ILLEGAL ASCII OPCODE or a PARAMETER OUT OF RANGE error message. On some commands, extra data or characters are ignored. Spaces and <CR> are always ignored and <LF> is the terminator.

MSB first data convention is used for multiple byte values.

Incorrect commands cause error messages (and a SRQ, if a function has been enabled) and are ignored.

2.4.8.4.2 Listening to the WJ-8969 Interface

The following highlights important details for listening to the WJ-8969 interface:

Controller queries the IFC unit with one of the valid query commands (those ending with a ?) and the IFC unit responds within a few hundred microseconds. The IFC unit assumes that it will be set up as a "talker" and that the IEEE-488 bus is available.

IFC units sends a <CR><LF> with each response to a query.

IFC unit can abort if the controller takes it out of the "talker" mode.

IFC unit follows a MSB first data convention for returning multiple byte values.

If a multiple command includes several query commands, the IFC unit puts a <CR><LF> between each response.

2.4.8.4.3 WJ-8969 Interface Address

Default address is selectable with a switch located on the IEEE-488/Interrupt CCA (A8). Factory setting is "005". This address cannot be changed remotely.

2.4.8.4.4 Bus Structure of the WJ-8969/IEEE-488 Interface

Sixteen transmission lines are used. DIO1 through DIO8 are eight message lines, permitting transfer of ASCII characters. The data is asynchronous and bidirectional. Three data byte transfer control lines (DAV, NRFD, and NDAC) permit "handshaking" between the ADU and the external computer. Five lines (ATN, IFC, SRQ, REN and EOI) are general interface management signal lines.

The following defines the 16 bus lines and their mnemonic definitions:

Message Lines

DIO1-DIO8 Data Input/Output - These lines carry data in a bit-parallel, byte-serial form. Data is asynchronous and generally bidirectional. These lines carry either data or address information, depending on the condition of the ATN line.

Control/Handshake Lines

DAV (Data Valid) - Used to indicate availability and validity of information on the DIO lines. DAV indicates to the acceptor(s) that data is available on the DIO lines.

NRFD (Not Read for Data) - Used to indicate that all devices are or are not ready to accept data.

NDAC (Not Data Accepted) - Used to indicate the acceptance of data by all devices.

Management Lines

ATN (Attention) - Used to specify how data on the data lines are to be interpreted and which devices must respond to the data. When ATN is true the DIO1-8 lines carry addresses or commands. When false, they carry data (controller driven).

IFC (Interface Clear) - Used to place the interface system in a known quiescent state. All interconnected devices contain some portions of the interface system. IFC puts talkers, listeners into their idle states (controller driven).

SRQ (Service Request) - Used to indicate a need for service and to request an interrupt of the current events sequence.

REN (Remote Enable) - This line with other messages, selects between two alternate sources of device programming data (example: front panel control or interface control) (controller driven).

EOI (End Or Identify) - Used to indicate the end of multiple byte transfer sequences or with ATN to perform a parallel polling sequence.

Commands	Description
AFC	Turn on AFC.
AFC/	Turn off AFC.
AFC?	What is the state of AFC? (AFC is on, AFC/ is off)
AGC	Turn on AGC.
AGC/	Turn off AGC.
AGC?	What is the state of AGC? (AGC is on, AGC/ is off)
AM	Turn on AM Detection Mode.
AM?	What is the AM modulation? (AMn)
BWC?	What is the bandwidth (in MHz)? (BWCn)
BWn	Select BWn (Where n can be 1 through 8).
BW?	What bandwidth is selected? (BWn)
CER	Clear all errors.
CHNn	Enable memory channel n.
CHN/n	Disable memory channel n.
CHNn?	Is memory channel n enabled? (CHNn or CHN/n)
CLC	Clear all lockout channels.
CLLf	Clear lockout at frequency f (in MHz).
CLM	Clear all memory and initialize the unit.
CLRn	Clear memory channel n.
CORn	Set COR Level to n. (where n can be from 00 to 60)
COR?	What is the COR level setting? (CORn)
CST?	What is the status of COR (CST = On, CST/ = Off)?
CW	Turn on CW Detection Mode.

Commands	Description
DET?	What detection mode is selected? (AM, FM, CW, or PLS)
ENLf	Enable lockout channel with frequency f (in MHz).
ENL/f	Disable lockout channel with frequency f (in MHz).
FBW	Set full bandwidth scan.
FBW/	Reset scan increment to half the bandwidth.
FBW?	Is full bandwidth scan increment set? (FBW or FBW/)
FM	Turn on FM Detection Mode.
FM?	What is the FM modulation? (FMn)
FMO?	What is the FM offset? (FMOn)
FPL	Turn front panel display on. This mode is set whenever the unit returns to local mode.
FPL/	Turn front panel display off.
FPL?	Is front panel display on? (FPL or FP/)
FRQf	Set tuned frequency in MHz.
FRQ?	What is the tuned frequency? (FRQf)
HBW	Set half bandwidth scan.
HBW/	Reset scan increment to full bandwidth.
HBW?	Is half bandwidth scan increment set? (HBW or HBW/)
HER?	What are the hardware error bytes? (HERn,m See Note 1.)
LCH?	What is the number of lockout channels used? (LCHn)
LCK	Lockout current tuned frequency and currently selected bandwidth.
LKFf,f	Lockout center frequency and bandwidth (in MHz).
LKRf,f	Lockout start frequency and stop frequency (in MHz).

Commands	Description
MAN	Set to Manual Mode.
MOD?	What is the front panel mode? MAN = Manual, SCN = Scan, STP = Step, SCM = Scanpause, STM = Steppause.
OPT?	What options are installed? (OPTn,m)
PARn,m	Partition memory. Channel numbers less than the first parameter are for scan. Channel numbers greater or equal to the second parameter are for lockout. Those between are for step.
PAR?	How is memory partitioned? (PARn,m)
PLS	Turn on Pulse Detection Mode.
PSE	Change from SCAN to SCANPAUSE or from STEP to STEPPAUSE state. If not in SCAN or STEP state, no action is taken.
QUE?	What are the frequencies in the SCAN/STEP queue? (QUE, f_1, f_2, f_3, f_4, f_5,...,f_{16})
RCEn	Recall and enter memory channel n.
RCHn?	What are the parameters of channel n? (See Note 3 for format)
RER?	What are the remote error bytes? (See Note 2)
RFGn	Set RF Atten (00 = Minimum, 99 = Maximum).
RFG?	What is the RF Atten? (RFGn)
RLKn?	What are lockout parameters (frequency, BW, or start and stop frequency) of channel n? (LCF f,bw) or (LCRf_1, f_2)
RMT	Place unit in remote control.
RMT/	Place unit in local control.
RMT?	Is the unit in remote or local control? (RMT or RMT/)
SCHxxx	Set memory channel parameters. (See Note 3)
SCIf	Set scan increment.
SCI?	What is scan increment (in MHz)? (SCIf)

Commands	Description
SCN	Use to continue scanning from scanpause state.
SCNn	Start scan using channel n as argument.
SS?	What is the signal strength (in - dBm)? (SSn)
SSOn	What are the Scan/Step options for channel n?
SSO?	What are the scan/step options? (SSOn)
STMn	Set status mask for serial poll status. (See Note 4)
STM?	What is the status mask? (STMn) Also, see Note 4.
STOn	Store currently active parameters in memory channel n.
STS?	What is the serial poll status byte? (STSn) Also see Note 5.
STP	Continue stepping from STEPPAUSE state.
STPn	Start step using channel n as argument.
VER?	What is the unit model and revision level? Response is in the form VER-8969 W.X.U. where W = letter revision of unit X = dash number of unit U = firmware letter designation

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Notes:

1. Hardware Error Bytes:

1	Tuner Reference unlocked
2	Tuner First LO unlocked
4	Tuner Second LO unlocked
8	Tuner RF section not powered
16	IFC A/D not converting
32	IFC - no bandwidths found
64	IFC - Illegal bandwidth code detected
128	Tuner not responding

1	Calibration of Tuner cable failed
2	Invalid message received from Tuner

Notes: (continued)

2. Remote Error Bytes:

Illegal ASCII code 1	
Invalid ASCII Argument	2
Invalid Memory Remote Channel	4
Lockout Not Found	8
Not in Remote	16
Illegal BW for CW	32

3. Memory Channel Parameters (xxx):mch - n
(memory channel number)
enb - ENB,ENB/
(enable/disable memory)
frq - f
bw - n
cor - n
det - AM, FM,CW, PLS
afc - AFC, AFC/
agc - AGC, AGC/
rfg - n

Format example: SCH5, ENB, 2050.52, 3, 20, FM, AFC, AGC/, 25

4. Status Mask:

4	Enable HARDWARE errors
8	Enable REMOTE errors
64	Enable SRQ function

5. Serial Poll Status Byte and Serial Poll Data Passed:

1	COR active	1=true , 0=false
2	SCAN signal activity flag	1=true , 0=false
4	HARDWARE ERROR	1=error , 0=no error
8	REMOTE ERROR	1=error , 0=no error
128	TUNER LO ERROR	1=no error, 0=error

CHAPTER III

CIRCUIT DESCRIPTION

3.1 GENERAL

This section provides a functional analysis and detailed theory of operation for the following major assemblies of the WJ-8969/IFC IF Demodulator and Control Unit.

1. Front Panel Display Assembly (A1), P/N 659480-001
2. Front Panel Keyboard Assembly (A2), P/N 659484-001
3. Front Panel Interface Assembly (A3), P/N 659490-001
4. Control Mother Board Assembly (A4), P/N 659496-001
5. Microprocessor Board (A5), P/N 659589-001
6. Analog Interface Assembly (A6), P/N 659501-001
7. Digital Interface Assembly (A7), P/N 659505-001
8. IEEE-488 Interrupt Assembly (A8), P/N 659509-001
9. Reference/Multiplexer Assembly (A9), P/N 659513-001
10. 160 MHz Filter/Gain Assembly (A10), P/N 659548-001
11. Demodulator Assembly (A11), P/N 659552-001
12. 21.4 MHz Filter/Converter Assembly (A12), P/N 659569-001
13. 160/21.4 MHz Log Amplifier Assembly (A14), P/N 660743-001

The descriptions are arranged in a logical signal-flow presentation. The table of contents should be consulted for locating descriptions of specific subassemblies and circuit boards.

3.1.1 DIAGRAMS AND SCHEMATICS

Figure 6-1 is a two-sheet overall functional block diagram of the IFC unit and Figure 6-2 is the IFC interconnect diagram. Detailed schematics for all assemblies and circuits within the assemblies are contained in Section VI. Reference is made to these schematics throughout the text and the schematics are correlated to Figures 6-1 and 6-2.

3.1.2 OVERALL DESCRIPTION

Figures 6-1 and 6-2 show the assemblies of the IFC unit which provide two main functions: (1) IF demodulation, and (2) receiver control. IF demodulation includes AM, FM, CW, and pulse. Control is through either front panel controls or by an external computer/controller via an IEEE-488 interface bus.

The IFC unit is closely related to the WJ-8969/TUXXXX Tuner unit and, among other interrelationships, provides a 10 MHz reference signal to the tuner unit. Together, the IFC unit and tuner unit comprise the basic WJ-8969 microwave receiving system.

A functional description of the tuner unit is contained at the end of this section, along with a functional block diagram of the unit. For details regarding the tuner unit, refer to RSU-633 which is the operation and maintenance manual for this unit.

3.2 REFERENCE MULTIPLEXER MODULE (A9)

3.2.1 FUNCTIONAL DESCRIPTION

Refer to Figure 6-1, Sheet 1 of 2 and Figure 6-2. The WJ-8969/IFC unit contains a reference/multiplexer module very similar to the A1 module located in the RF tuner unit (see RSU-633). The reference/multiplexer module generates the necessary reference signal needed by the IFC and RF tuner units and performs a frequency multiplex/demultiplex of the half duplex data, 10 MHz reference, and 160 MHz IF onto the receiving system's single interconnecting cable.

The 10 MHz reference signal is provided by a high stability temperature compensated crystal oscillator. When an external 10 MHz reference signal is applied to the rear panel of the receiver, the internal 10 MHz crystal is switched off. The receiver's frequency accuracy performance will thus be dependent upon the external reference used.

The 10 MHz signal is filtered and sent to the 21.4 MHz filter/converter module as a reference. The 10 MHz signal is also band-pass (multiplexed) filtered and sent out over the interconnecting cable to provide the reference for the tuner. The serial data to and from the tuner is low pass filtered and put on to the same interconnecting cable.

The 160 MHz IF from the tuner is high pass filtered to remove it from the input cable aggregate signals. The IF signal is then amplified. A coupler follows the amplifier with the 10 dB coupled port becoming the WJ-8969 receiver's 160 MHz signal monitor IF output (J6).

The through port of the coupler is sent through a variable attenuator which provides 0 to 30 dB of range and is used to adjust for general gain distribution in order to maximize dynamic range of the receiver. Following the attenuator is a power divider with one output going to the 160 MHz filter gain module and the other output going to the 21.4 MHz Converter/Filter Module.

3.2.2 DETAILED DESCRIPTION

3.2.2.1 10 MHz Reference Generator CCA (A9A1)

Refer to Figure 6-3. This board uses either an internally generated 10 MHz reference signal or a user-supplied external 10 MHz reference signal. The user-supplied 10 MHz is designated 10 MHz EXT IN and appears at connector E1 on this board. The external 10 MHz reference, if used, comes into the rear panel of the IFC unit at BNC connector J5 10 MHz EXT REF IN.

U1, shown at the middle left side of the schematic, is a line driver/receiver. It receives the 10 MHz reference input, if there is one, or detects the absence of an external reference. If there is no external reference, the output of U1-1 turns on Q1 which is driven into saturation, which then turns on the 10 MHz crystal oscillator (Y1). The output of U1-7 goes to U2-9. The two sections of U2 (bus buffer gates with tri-state outputs) are buffers which square up the 10 MHz signal. This signal is then low-pass filtered by L7 and C12. The signal then goes to the 21.4 MHz module (A12) where it is used to lock the 138.6 MHz oscillator in that module.

R11 is a pull-up resistor. R12 is a buffer resistor and R13 represents a 50-ohm impedance matching resistor. C6 is a dc-blocking capacitor.

R1, C1, R2, R3, R5, C2, and C3 are the buffering network of pull-up and pull-down resistors to set the right direction on the line driver/receiver. If any of these components fail, it is possible that you might not detect the external reference signal when there is one; or it might be detected at the wrong power level.

As stated, Q1 is used to switch on or off the internal 10 MHz reference. If there is no external reference signal, U1-1 would be low. Since U1-1 is low, the base of Q1 (which is a PNP transistor) is negative and Q1 turns on, causing +5V to appear at Y1-2. A voltage drop appears across R6 and there is a voltage between the base and emitter of Q1 causing it to conduct. Y1-2 is the supply voltage pin for Y1.

When Y1 is operating, meaning that the 10 MHz internal reference signal is being used, the output of Y1 is connected to U2-12. U2-10 is the control signal for turning on or off the high-Z state of U2/A.

The filters on this board (A9A1) and those on the 160 MHz board (A9A2) constitute the multiplexing circuitry. Three signals (160 IF, data, and 10 MHz reference) are multiplexed on to the same line.

The 10 MHz signal goes through a band-pass filter. This is a bidirectional filter which prevents any 160 MHz signal or any half-duplex data from feeding back into the circuit. The half-duplex data goes through a serial data low-pass filter (L2, L6, L8, C10, and C11). The direction is from pin E6 through to pin E4. The rest of the filter is located on the 160 MHz filter/gain control board (A9A2). The 10 MHz goes through some more filtering and then the data goes through more filtering and the 160 MHz goes through a high-pass filter.

All the information gets multiplexed as a composite signal which goes between the IFC and tuner units.

The high-pass filter passes signals above 100 MHz (the receiver is designed to have as much as 40 MHz of bandwidth, although it may go up to 100 MHz of bandwidth for some users). The filter is rejecting, specifically, the 10 MHz signal and half-duplex data. There is no interest in information below 100 MHz, so only information above 100 MHz is passed.

The data filter has a 3 dB point of approximately 1 MHz, so this low pass filter attenuates signals above 1 MHz.

The 10 MHz filter is designed to reject any harmonics of 10 MHz that would potentially get into the IF passband. You could have a 16th harmonic that could get into the IF passband. So it starts rejecting harmonics at the next harmonic (or 20 MHz).

3.2.2.2 160 MHz Filter/Gain Control CCA (A9A2)

Refer to Figure 6-4. This board provides gain control and filtering for the 160 MHz IF signal. The circuit which receives the ATTN A signal at pin-3 (see the middle left side of the schematic) is a voltage-to-current converter. U3 (the variable attenuator shown on the right side of the schematic) is a more linear device when it is current-operated. Thus, it attenuates more linearly in proportion to the current being provided. Typically, U3 is used as a voltage-controlled attenuator but it operates more optimally as a current-controlled device.

CR3, CR4, R9, R10, and R11 form a voltage shaping network to accommodate any nonlinearities of attenuation versus control voltage. The combination of Q1, Q2, U5A, and U5B form a constant-current driver for U3. This improves stability with temperature changes. Q1 is the pass transistor.

U5B, combined with Q2, forms a current loop so that the current through R3 and R4 is equal to the current through R1 and R2 which are in series with U3. This is so that the current can be monitored and compared with the control voltage input to U5A. U5A controls the operation of Q1.

The current is maintained through R3 and R4 by U5B, which compares the current through R1 and R2. The feedback loop, including Q2 and the op amp, is stable when the differential voltage to the input of the op amp is zero. This means that there is equal current through R1 and R2.

The conduction of Q2 is controlled by U5B. All the current that flows through Q2 flows through R3 and R4.

CR2 prevents reverse current from going through Q2. R7 ensures that Q2 turns off. C6 and C7 help stabilize the loop. R5 turns off Q1. R6 limits the current driving Q1. R8 stabilizes the input impedance.

R4 is adjusted if the desired output of the attenuator does not track the input control voltage appearing at pin 3 of the board connectors. A certain input voltage should produce a certain amount of attenuation in U3. If this does not occur, then adjust R4 until both the control voltage and attenuation track each other.

U2 is a bidirectional coupler. One path is to E6 which is attached to a semirigid cable whose other end is connected to 160 MHz SM Out connector J6 on the rear panel of the IFC unit. The other path is to attenuator U3.

U4 is a power splitter which divides the 160 MHz signal. One output goes to the 160 MHz filters. The other output goes to the 21.4 MHz filter/converter module (A12) in the 160 MHz filter/gain module (A10).

3.3 21.4-MHz CONVERTER/FILTER MODULE (A12), P/N 659569-001

3.3.1 FUNCTIONAL DESCRIPTION

Refer to Figure 6-1, Sheet 1 of 2 and Figure 6-2. Figure 6-5 is the module interconnect diagram. The 21.4 MHz converter/filter module performs the special processing of the 160 MHz IF necessary to provide the narrow bandwidth filtering for the 21.4 MHz IF. The 160 MHz IF output from the reference/multiplexer module (A9) is passed through a 10 MHz bandwidth filter and an amplifier to provide matching and isolation. The filter removes interfering signals at and about 117.2 MHz, which is the image frequency of the converting process performed in the mixer at the input of the converter module.

A 138.6 MHz oscillator, which is phase locked to the reference oscillator, is used to mix with the 160 MHz IF to produce a 21.4 MHz IF. The output of the mixer is low pass filtered and amplified. The output of the amplifier is power divided. One half of the signal is brought out to the back panel as the 21.4 MHz IF output while the other signal is switched through one of up to four different 21.4 MHz filters.

The bandwidth selection is from a minimum of 10 kHz to a maximum of 5 MHz. The output of the bandpass filters is amplified once for bandwidths greater than 500 kHz and twice for bandwidths less than 500 kHz. The 21.4 MHz signal from this module is sent to the 160 MHz filter/gain module (A10).

A 21.4-MHz BFO oscillator circuit is contained in this module to provide a carrier frequency so that the demodulator can detect CW signals when the system is in the "CW Mode" of operation. CW signals are considered narrow bandwidth with single sidebands or double sidebands, but having a suppressed carrier.

The 21.4-MHz output of this circuit is connected to the detector CCA (A11A1). The circuit is turned on or off by the "CW" logic level signal. This signal originates on the digital interface CCA (A7).

3.3.2 DETAILED DESCRIPTION

3.3.2.1 General

The 21.4 MHz Converter/Filter assembly (A12) converts the 160-MHz IF signal, generated in the tuner, to 21.4 MHz, where the signal can be processed by narrow bandwidth filters and provide a signal monitor output for narrow-band processing by external equipment. The assembly consists of four circuit boards: A12A1, A12A2, A12A3, and A12A4. Details of each board are described in the following major paragraphs. Figure 6-5 shows the interconnection of the CCAs.

3.3.2.2 160-to-21.4-MHz Converter CCA (A12A1), P/N 660840-001

Refer to Figure 6-6. This board does the IF processing. The 160-MHz signal comes in to terminal E2 and goes to an attenuator comprised of R5, R6, and R7. Normally this attenuator is set for 10 dB attenuation; however, if a mismatch problem exists between the filter and mixer, or if there is excess gain in the receiver system, this pad can be increased and used to improve the VSWR or reduce the gain level. The attenuator components are factory-selected and must not be changed in the field.

Mixer U1 receives the output of the attenuator at pin 1, which is its R-port. The L-port is pin 8 and the 138.6 MHz LO signal input, generated on CCA A12A4, comes to this port from terminal E4. The LO signal at E4 has a power level of +14 dBm. Pins 3 and 4 of mixer U1 are its I-port. U1 mixes the 160 MHz IF with the 138.6 MHz LO to produce a 21.4 MHz IF output.

The inductor/capacitor/resistor network comprised of L1, L2, L3, C1, C2, C3, and R4 is a high-pass/low-pass filter combination. C1, C2, and L1 pass the high frequencies of 138.6 and 160 MHz into resistor R4 to provide a 50-ohm termination for the mixer and these high frequencies. The 21.4-MHz IF frequency passes through the low-pass filter (L2, L3, and C3) into IF amplifier U2 which has a gain of 22.5 dB. The output of U2 goes to power splitter U2.

One output of U2 goes to terminal E3 which is connected to a BNC connector (a 21.4-MHz signal monitor output) for use by either an IF PAN or IF tape converter or some other external equipment. The other output of U2 goes to P1 which is cabled to J2 on the A12A3 CCA.

3.3.2.3 138.6-MHz Oscillator CCA (A12A4), P/N 661534-001

Refer to Figure 6-7. This circuit generates a 138.6 LO signal used by mixer U1 in CCA A12A1. G1 is a VCXO whose frequency output is controlled by the input signal at terminal E3. The 138.6 MHz output is amplified and buffered by U1 and is connected, via terminal E1, to terminal E4 on the 160 - 21.4 MHz converter CCA (A12A1) where it is used as the LO input to the mixer on that CCA.

For the purpose of phase-locking G1, the 138.6 MHz output of G1 at terminal E2 is connected to a terminal E6 on 21.4 Oscillator CCA (A12A2). Ultimately, this input to A12A2 is converted to a 10 MHz signal and compared with a 10 MHz reference. Any difference in this comparison is sent to G1 on A12A4 as a correction voltage to phase-lock G1 to the reference.

The correction signal is termed "Input Voltage Control" since any change in this voltage corrects the output of G1 (a VCO) to maintain the desired stable 138.6 MHz output. L1, L2, and C4 comprise a bandpass filter, centered at 138.6 MHz, to reduce any harmonically related spurious signals. Capacitor C6 is factory-set and is used to peak the output of U1.

3.3.2.4 21.4 BFO Oscillator CCA (A12A2), P/N 660832-001

Refer to Figure 6-8. The 138.6 MHz signal from E2 on A12A4 is coupled to high-frequency prescaler U4 (pin-5) via terminal E6. U4 performs a divide-by-32 or -33 on the 138.6 MHz signal. The output of U4 (pins 2 and 3) is connected to U2, which is a phase-locked-loop control integrated circuit. It performs divide-by-N for the signal from U4 and provides a control input to U4 to control whether or not U4 divides by 32 or 33. It also divides, to a common frequency, both the reference and the LO for phase detection. These two frequencies are compared in a phase comparator internal to U2.

The output of the phase comparator is on pins 7 and 8 (phase R and phase V). These are pulse-type signals that appear as a function of whether the reference signal frequency is high or low. These output pulses are filtered and integrated by the network of components around amplifier U3. The output voltage is connected to the input of G1 on A12A4 and phase locks the 138.6 MHz oscillator to the reference. CR1 prevents the voltage going to G1 from being negative.

The 10 MHz reference signal, from the 10 MHz reference generator circuit in the reference/multiplexer module A9 (refer to paragraph 3.2.2 for details), is coupled to terminal E4 which connects it, via dc decoupling capacitor, to the base of Q4. Q4 acts as a buffer/amplifier. The output of Q4 goes to U1A.

U1A and U1B are decade counters configured to act as divide-by-five frequency dividers. Together, they provide a total division of 25. U1A divides the 10 MHz output from Q4 by five, resulting in a 2 MHz frequency. This frequency is divided by five via U1B. The resulting 400 kHz is connected to U2-27 where a counter, internal to this PLL chip, divides the 400 kHz by eight to obtain 50 kHz. This internal division is possible because pins 4, 5, and 6 of U2 are grounded. Thus, the phase reference signal is 50 kHz.

The 138.6-MHz signal is divided by 2772 to achieve 50 kHz. This division is accomplished as follows. The circuitry of U2 contains two counters (A and N). The "A" counter is programmed to count to 20 and the "N" counter is programmed to count to 86. Thus, the prescaler is commanded, via the modules control, to divide by 33 a total of 20 times and to divide by 32 for 66 times. This gives a total of 86 counts. Mathematically, the calculation is as follows: (20 x 33) + (66 x 32) = 2,772 [or (86 x 32) + 20 = 2,772].

The two 50-kHz signals are compared in the U2 phase comparator and the pulses that appear on pins 7 and 8 of U2 will have a frequency of 50 kHz. The main loop filter for this overall phase-locked loop consists of R17 and C18 in the U3 circuit. Since the drive signal for U3 is a differential signal, R16 and C20 serve to balance the gain at all frequencies for the differential-to-single-ended converter. R12 and C16 and R13 and C17 form an auxiliary low-pass filter to filter out the 50-kHz reference signal information. By using a differential signal from pins 7 and 8 of U2, high common-mode rejection is obtained.

With the voltage on the varactor diode at zero, the frequency of the oscillator is slightly low, so the correction voltage is positive. Thus, as the average voltage at pin 7 of U2 increases, the oscillator frequency decreases. When the voltage decreases, the frequency increases due to the inversion in U3.

Transistors Q1, Q2, and Q3 and crystal Y1 form a circuit that is a 21.4-MHz oscillator (see upper left side of Figure 6-8). Crystal Y1 and transistor Q2 form the basic oscillator. Transistor Q3 is a buffer for the oscillator so it can drive the demodulator module where this 21.4 MHz signal is used in the CW mode. Transistor Q1 is used as a switch to turn power on and off to Q2 and Q3, thus turning the oscillator on and off. The logic signal labeled CW is used to control Q1.

3.3.2.4 21.4-MHz IF Filter CCA (A12A3), P/N 660836-001

Refer to Figure 6-9. This CCA is used to hold the 21.4-MHz filters. They are crystal filters for bandwidths of 300 kHz or less and L-C filters for bandwidths of greater than 300 kHz. Up to four filters can be mounted on this CCA.

U1 is used as a demultiplexer for the logic control signal that comes from the microprocessor and also from the demodulator assembly A11. The 21.4/160 MHz signal comes from the demodulator to turn this CCA on and off. Filter selection is performed by the microprocessor outputs BW 0 and BW 1.

U2 is a quad-operational amplifier and is used to turn on the PIN diode networks at the input and output of each filter. The appropriate amplifier (U2-A, -B, -C, or -D) is energized and drives the appropriate diodes to turn the filter on. The 21.4-MHz IF input that has come from the 160-to-21.4 MHz converter CCA (A12A1) is then switched through the appropriate filter.

The output of the filter is connected to amplifier U4 which has 12.7 dB of gain and a 5.5 dB noise figure. When narrow bandwidths (less than 300 kHz) are selected, additional gain is required to increase the noise floor into the demodulator. In the narrow bandwidths, U6 provides energy to the appropriate set of diodes to either switch or not switch amplifier U5 into the circuit. U5 has a gain of 14.7 dB and a noise figure of 4 dB. The output of this CCA is connected to the 160-MHz filter/gain CCA (A10). Resistors R26 and R27 terminate the input and output of amplifier U5 when it is not being used.

3.4 160-MHz FILTER/GAIN ASSEMBLY (A10)

3.4.1 FUNCTIONAL DESCRIPTION

Refer to Figures 6-1 and 6-2. The 160-MHz IF signal from the reference/multiplexer module is also routed to the 160-MHz filter/gain module. The signal is passed to the pin diode switches used to select the desired wideband IF filter. Four filters can be accommodated in the assembly, with bandwidths in the range of 5 MHz to 50 MHz. The filters are

plug-in types which are easily field replaceable, but must be configured to correspond to plug-in equalizer packs in the demodulator assembly. The 21.4-MHz band limited IF signal is also routed to this module.

The 21.4-MHz IF signal or the 160-MHz IF signal from the selected narrowband filter is passed to the remainder of this IF chain. The selected IF signal is buffered before encountering a voltage controlled attenuator. The majority of the attenuation available at this point is used for bandwidth normalization, while the remainder is used for manual and automatic gain control.

One of three IF roofing filters is switched into the signal path after the attenuator. The bandwidth of the filter is two to three times the IF bandwidth and is used to limit the broadband noise from the preceding amplifier. Following the roofing filters, the IF input signal is passed through the IF gain control circuitry. This circuitry incorporates a series of amplifiers and voltage controlled attenuators to provide the necessary range of gain control.

The 160-MHz filter/gain module allows a minimum of 70 dB of gain control, in addition to the 30 dB of gain control located in the reference/multiplexer module. The individual attenuators are controlled by the microprocessor in both the automatic and manual modes. The IF output signal is routed to the demodulator assembly.

3.4.2 DETAILED DESCRIPTION

This assembly contains seven CCAs (circuit card assemblies):

1. Input Switch board (A10A1)
2. Filter Board board (A10A2)
3. Filter Board board (A10A3)
4. Output Switch board (A10A4)
5. IF Roofing Filter board (A10A5)
6. AGC (automatic gain control) 1 board (A10A6)
7. AGC 2 board (A10A7)

Figure 6-10 is the assembly interconnect diagram. CCAs A10A1 and A10A2 are identical boards and function identically. CCAs A10A6 and A10A7 are also identical boards and function identically.

3.4.2.1 Input Switch CCA (A10A1)

Refer to Figure 6-11. This board performs all the switching of the 160-MHz IF signal to route the signal to one of four 160-MHz bandpass filters or provides a bypass route which bypasses the filters entirely.

The board consists of five identical circuits, each one of which contains a diode (CR1 through CR5) in series with the input signal and a shunt diode (CR6 through CR10) to ground. All the diodes are a PIN type. These diodes are biased into their active regions at different times. The

diode in series with the signal is turned on and the shunt diode is reverse-biased to present a high impedance to ground. This is for the active signal path.

For all the other signal paths, the series diode is reversed biased, blocking the signal flow; the shunt diodes are shorted to ground so that there is a good ground path for signal blocking.

Resistors R2 through R6 are the current limiting resistors for the "on" diodes. Additional current limiting is also performed by R1.

R7 through R11 are series resistors to isolate the switching diodes, located on the input switch CCA (A10A4), which are at the other end of this overall filter chain.

The "bypass" signal line is connected from E2 to an SMA connector and routed through semirigid cable. This signal is routed to the other end of the filter chain (A10A4) for the bypass filter mode.

E3 and E4 are the signal lines for filters FL1 and FL2. These signal lines are connected to an SMA connector and routed through semirigid cables to A10A3, which is a filter board in the assembly.

E5 and E6 are spring sockets which accept the input pins for the bandpass filters 3 and 4. These L-C filters are plug-in types in a rectangular package for PC mounting. The filter pins plug directly into spring sockets E5/E7 and E6/E8. E5 and E7 are just ground connections to the input switch board.

The output end of the filters plug into 160 MHz filter CCA (A10A2). There are two identical boards of this type. They accept the inputs and outputs from the filters. There is a trace on each board, which connects to SMA connectors.

On the input switch CCA (A10A1), control lines for the PIN diode switching are brought in through P1 to J1 and routed to the current-limiting resistors R7 through R11. The control lines are generated on output switch CCA (A10A4).

Capacitors C7 through C11 are used to stabilize the control line voltage at this point. Inductor L1 is for transient suppression to stabilize the dc voltage at this point. C1 is a dc decoupling capacitor for ac coupling. L1 presents a high impedance to the high frequency signals at this point. Together, L1 and R1 provide a dc path for the switching currents for the diodes. This path should be a 470 ohm impedance for dc currents, but for high frequencies it will be an open circuit.

3.4.2.2 Filter CCAs (A10A2 and A10A3)

These are identical boards. They simply accept pin connections to the filters, using sockets that are mounted on each board. Each board has a simple trace which brings the connections to forked terminals where semirigid cable is mounted to the terminals. Due to the simplicity of these CCAs, there is no schematic for them.

For A10A2, E1 through E4 are used to accept the output signals from FL3 and FL4 and route these signals to semirigid cables so they can be carried down to the end of the assembly.

For A10A3, E1 through E4 connect to the inputs of FL1 and FL2. E6 and E5 carry the input signal from the filters to this board.

3.4.2.3 Output Switch CCA (A10A4)

Refer to Figure 6-12. This board accepts the output signals from all of the 160 MHz bandpass filters as well as the bypass signal and the 21.4 MHz IF signal. The filtered 160 MHz signals come in on E2 through E5. The bypass signal is on E1; the 21.4 MHz IF is on E8.

FL1 and FL2 plug directly into this board, on E2/E6 and E3/E7. The output signals from FL3 and FL4 are carried from board A10A2 through semirigid cables to E4 and E5. The signals from the filters outputs, and the bypass signal (on E1), are all routed to PIN diodes used to select the output signal from the filters.

PIN diode switches receive the inputs and outputs of the filters and are used for isolation from one filter path to the next. If only one switch was used the isolation would be +30 to +40 dB; the intent is to get +60 to +70 dB isolation/attenuation outside of the filter's bandpass. So we must totally shut down the bypass line. If a narrowband filter is used, there must not be any feed-through from any wider bandwidth filters.

Capacitors C1 through C4, C12, and C10 are all decoupling capacitors in series with the signal path to isolate the portions of the signal lines which have dc on them, for the purpose of switching the PIN diodes CR1 through CR2. CR6 and CR9 are the shunt diodes to ground for turning-off signal paths. CR10, CR11, CR12, CR8, CR7, and CR5 are the series diodes which are forward-biased when selecting a signal. CR5 and CR7 are the pair for the 21.4 MHz path.

L1 and R3 form a dc return path for the diode currents when a 21.4 MHz signal is selected. R4 is a current limiting resistor for the diodes' currents in the 21.4 MHz path.

L2 and R12 function similar to L1 and R3 for the 160 MHz path. C16 is a decoupling capacitor in series with the output of op amp U5.

The signal that is selected is routed through C16 to U5 and then out through J1 as the IF input to IF roofing filter board (A10A5). U5 provides both gain and isolation. DC input power is wired to connectors E9 through E13. C5 through C7 are power supply bypass capacitors.

Resistors R5, R6, and R7 form an attenuator circuit to match the equivalent losses through the filters. This is the bypass path. Since there is no filter at this point, there is a need to match the signal levels with the other signal paths.

R4, R8 through R11, and R13 are current limiting resistors for the diodes. Capacitors C14, C15, C18, C19, C13, and C11 are filters to stabilize the dc voltage at this point and minimize switching transients.

The control logic for selecting the appropriate PIN diode switch is located on this CCA. U1 is a binary decoder to decode the bandwidths. BW1 and BW0 lines come in on E16 and E17. These bandwidth lines are generated by the microprocessor (A5). They are TTL signals applied to U1 which decodes the addressing and generates the appropriate control signal to select one of four switch diodes used to select the appropriate filter in the IFC unit.

The bypass control line is applied to U1 to suppress the control lines if the filters are bypassed. The output lines from U1 are applied to the inputs of op amps U2, U3, and U4 used as comparators to compare the logic levels from U1 to a reference voltage which is generated by the voltage divider formed by R1 and R2. C8 is a low pass filter to stabilize the dc level at the inputs to the comparators.

U2 through U4 form the filter select logic and are used to generate the drive current for turning on and off the pin diodes. Their outputs are routed to the appropriate current limiting resistors as well as to J2 (which is the connector routing the switch control lines back to input switch board A10A1). When one of the PIN diodes on this board is turned on, a corresponding diode (at the input to the filters) is turned-on on CCA A10A1. All the other PIN diodes are turned off.

3.4.2.4 IF Roofing Filter CCA (A10A5)

Refer to Figure 6-13. This board contains the IF roofing filters and switches in the appropriate roofing filter circuit depending on which IF filter has been selected by the operator. The purpose of the filters is to limit the broadband noise from the preceding amplifiers for purposes of signal to noise ratio optimization in the IFC. The bandwidth of the roofing filters are at two to three times the BW of the selected IF bandpass filter. So the roofing filter should not affect the signal frequency response within the passband--but are simply to limit the noise that would be generated by the preceding amplifiers outside the desired passband.

The circuit which receives the ATTN D signal at J2-9 (see the left side of the schematic) is a voltage-to-current converter. U1 (the variable attenuator) is a more linear device when it is current-operated.

Thus, it attenuates more linearly in proportion to the current being provided. Typically, U1 is used as a voltage-controlled attenuator but it operates more optimally as a current-controlled device.

VR1, VR2, R1, R2, and R3 form a voltage shaping network to accommodate any nonlinearities of attenuation versus control voltage. The combination of Q1, Q2, U2A, and U2B form a constant-current driver for U1. This improves stability with temperature changes. Q1 is the pass transistor.

U2B combined with Q2 forms a current loop so that the current through R10 and R11 is equal to the current through R7 and R8 which are in series with U1. This is so that the current can be monitored and compared with the control voltage input to U2A. U2A controls the operation of Q1.

The current is maintained through R10 and R11 by U2B, which compares the current through R7 and R8. The feedback loop, including Q2 and the op amp, is stabilized when the differential voltage to the input of the op amp is zero. This means there is equal current through R7 and R8.

The conduction of Q2 is controlled by U2B. All the current that flows through Q2 flows through R10 and R11.

CR2 prevents reverse current from going through Q2. R9 ensures that Q2 turns off. C2 and C3 help stabilize the loop. R6 turns off Q1. R5 limits the current driving Q1. R10 stabilizes the input impedance.

R11 is adjusted if the desired output of the attenuator does not track the input control voltage appearing at J2-9. A certain input voltage should produce a certain amount of attenuation in U1. If this does not occur, then adjust R11 until both the control voltage and attenuation track each other.

Regarding the roofing filters, if you drew a spectral noise distribution figure, as you come out of these filters, you would see what appears to be a flat roof to the noise and then it comes down on either side--but on the top of that would be superimposed the passband of the bandpass filter.

The selection signal comes to P1, which is connected to the input of variable attenuator U1; J1 is located on the output switch board A10A4. J1 is a SMA slide-on connector. Board A10A5 plugs into A10A4 through a wall in module A10. U1 is a WJG1 current-controlled attenuator.

The control current for U1 is generated from the voltage-to-current circuitry (located on the left side of the schematic). The control voltage, which is generated by the microprocessor, via the analog interface board, comes through the motherboard to connector J2--which interfaces the module to the outside world. J2-9 is where the control signal appears.

The output of U1 goes through decoupling capacitor C39 which isolates dc levels present on the output of U1 due to the currents and voltages used to activate and deactivate the PIN diodes. CR3, CR5, and CR7 are series PIN diodes. CR4, CR6, and CR8 are shunt PIN diodes to ground. The series diode is turned on when the shunt diode is off and vice-versa. These diodes are used to route the IF signal, which is either 21.4 MHz or 160 MHz, to the appropriate roofing filter circuit.

Discrete components are used to construct the bandpass filters which are used as roofing filters.

The first filter (starting from the top of the schematic) is the 160 MHz roofing filter; the bandwidth is approximately 75 MHz, centered at 160 MHz. It is a third-order, singly terminated Butterworth response bandpass filter, as are the other roofing filters. The trimmer C14 is used as a fine adjustment of the filter's center frequency.

To verify the proper operation of the filters you would sweep the input signal frequency and look at the amplitude response of the filter, and make sure that it is centered properly and that you have proper insertion loss, skirt shape, and group delay.

The second filter, centered at 21.4 MHz, has a bandwidth of 10 MHz, at the 1 dB down point, and 15 MHz of bandwidth at 3 dB down.

The third filter, also centered at 21.4 MHz, has a bandwidth of 1 MHz.

The control lines used to switch the PIN diodes are generated by U4 and U5. R15 and R19 form a voltage divider to set up a reference voltage at the inverting inputs of these comparators. R22 and CR9 are part of the logic used to decode the bandwidth lines (BW0, BW1, and BW2) on pins 4, 3, and 1 of J2, as well as the 21.4/160 line [which is generated in the demodulator module (A11)]; the 500 kHz line is generated by the microprocessor.

There is no decoder IC on this board, as there was for the output switch board (A10A4). The logic for decoding the input lines and determining which roofing filter to switch in is all inherent in the interconnections and the circuit topology of U4/U5, and R22/CR9.

Jumper wires W1 and W2 are normally connected as shown. Special requirements by a user could use different jumper connections. In this case, the jumper connections will be specified on a "difference data sheet" located at the front of this manual.

The outputs of the roofing filters go through a PIN diode switching arrangement similar to that previously discussed for other circuit boards in this module. The reason for individual switches at the inputs and outputs of each filter is for isolation between filters and the ultimate attenuation of the signal.

L11 and R20 form the dc return path for the diode currents. C36 provides dc decoupling for the signals.

Amplifier U3 provides isolation and gain. L12, R21, and C29 are the bias circuit and supply bypassing components for U3. C41 is a series decoupling capacitor.

U6 is a power divider which splits the selected, band-limited and noise-limited IF signal. Half the signal goes to E2, which is a forked-terminal to connect the signal to the SMA connector in the wall of the module for the connection to the optional Log amp/Log detector module. The other half goes to E1 which is a forked-terminal for connection of semirigid cable to carry the IF signal on to the AGC 1 and 2 boards (A10A6 and A10A7).

The spring sockets (E8, E10, E11, E9, etc.) accept the feed-through capacitor pins that are mounted on the wall of the module to carry supply voltages and control lines to the other side of the module. There are similar spring sockets located on board A10A4.

ATTN C and ATTN B control voltages, which come in on pins J2-14 and J2-15, are routed to J3 and J4 (which are connectors that are used to carry these control lines and supply voltages to the AGC1 and AGC2 boards).

The supply voltages come in on J2-5, -6, -7, and -11. The capacitors are used for ac bypass. ATTN A is the control voltage for the attenuator located in the reference/multiplexer module (A9).

3.4.2.5 AGC 1 and AGC 2 CCAs (A10A6 and A10A7)

Refer to Figures 6-14 and 6-15. These are the Automatic Gain Control boards. The boards are identical and contain amplifiers for gain and a current-controlled attenuator so that the microprocessor or the operator can vary the IF gain of the IFC, as desired, to center the signal within the detector usable range. The only difference between Figures 6-14 and 6-15 (the schematics for the boards) is the input and output signal designations and source and destination of the signals.

The circuit which receives the ATTN C and ATTN B signal at J1-1 (see the left side of the schematics) is a voltage-to-current converter. U1 (the variable attenuator) is a more linear device when it is current-operated. Thus, it attenuates more linearly in proportion to the current being provided. Typically, U1 is used as a voltage-controlled attenuator but it operates more optimally as a current-controlled device.

VR1, VR2, R6, R7, and R9 form a voltage shaping network to accommodate any nonlinearities of attenuation versus control voltage. The combination of Q1, Q2, U2A, and U2B form a constant-current driver for U1. This improves stability with temperature changes. Q1 is the pass transistor.

U2B combined with Q2 forms a current loop so that the current through R4 and R5 is equal to the current through R1 and R2 which are in series with U1. This is so that the current can be monitored and compared with the control voltage input to U2A. U2A controls the operation of Q1.

The current is maintained through R4 and R5 by U2B, which compares the current through R1 and R2. The feedback loop, including Q2 and the op amp is stabilized when the differential voltage to the input of the op amp is zero. This means there is equal current through R1 and R2.

The conduction of Q2 is controlled by U2B. All the current that flows through Q2 flows through R4 and R5.

CR2 prevents reverse current from going through Q2. R3 ensures that Q2 turns off. C6 and C13 help stabilize the loop. R10 turns off Q1. R11 limits the current driving Q1. R8 stabilizes the input impedance.

R5 is adjusted if the desired output of the attenuator does not track the input control voltage appearing at E2. A certain input voltage should produce a certain amount of attenuation in U1. If this does not occur, then adjust R5 until both the control voltage and attenuation track each other.

Refer to Figure 6-14. The IF input signal, appearing at E1, on the upper left side of the schematic, comes from the IF roofing filter board (A10A5). E1 is a forked terminal for the semirigid cable coming from A10A5. The signal goes into U1, which is a WJG1 current-controlled attenuator. U1 provides attenuation control from -2 dB to -32 dB.

Amplifier U3 has a 20 dB gain and amplifier U4 has a 14 dB gain. The components in the +15 Vdc circuits for U3 and U4 are the biasing network, bypass components, and the series decoupling capacitors.

The control line for attenuator U1 comes in on J1-1 and is designated ATTN C (see Figure 6-14). The dc supply voltages also are at connector J1.

Refer to Figure 6-15. The control line for U1 comes in on J1-1 and is designated ATTN B.

After going through AGC 1 and AGC 2 boards, the IF output (E2), on Figure 6-15, is then routed back to the wall of the module for connection to the demodulator module (A11).

3.4.2.6 IFC Unit Attenuators

The attenuators used in the IFC unit, and discussed in previous paragraphs, are used for gain control, in a certain order, so that noise figure is minimized. The microprocessor decides which attenuator it is going to use to change the attenuation. The order in which the attenuators are used, and when they are used, is transparent to an operator. Thus, the operator does not have to worry about attenuator selection.

The microprocessor selects the attenuators as follows. When attenuation is increased, it starts with ATTN D, until its usable range is exhausted; then ATTN C is used; and then whatever range of ATTN B is allowable to use outside the bandwidth normalization range; and then finally ATTN A (located in the reference/multiplexer module A9) is used to increase attenuation. To decrease attenuation, the opposite order is used. This attenuation decrease is also under microprocessor control.

3.5 DEMODULATOR/VIDEO SWITCHER ASSEMBLY (A11)

3.5.1 FUNCTIONAL DESCRIPTION

Refer to Figure 6-1, sheet 2 of 2 and Figure 6-2. The demodulator module receives the final IF signal from the 160 MHz Filter/Gain Assembly. As the final IF signal is bandwidth defined and gain controlled, the demodulator module converts the IF signal to baseband video with amplitude and frequency detectors.

Upon entering the demodulator module, the IF signal is power split. One half of the IF signal is directed to the limiter circuitry which removes the amplitude information from the IF signal. The other half of the IF signal is split again. One half is attenuated and sent to the back panel to become the switched IF output (J10). The other half is sent to a mixer where it is converted to AM baseband by mixing with the input IF signal coming out of the limiter.

The detection circuitry is called a synchronous detector. This detector provides an extended dynamic range of 40 dB (typical). This compares to a simple diode detector where only 25 dB of dynamic range is typical.

The output of the AM detector mixer is passed through a low pass filter which is switched to remove any 160 MHz or 21.4 MHz interference. The baseband video is then amplified to the proper signal level to drive the low impedance AM video output (J8). A second output of the limiter is used to drive one of three FM discriminators. For wideband signals (10 MHz to greater), a 160 MHz delay line discriminator is used. For medium bandwidths (0.5 to 5.0 MHz), a 21.4 MHz delay line discriminator is used. For the narrow bandwidths (300 kHz or less), a special crystal discriminator is used.

The outputs of each of these discriminators are sent to equalizer networks. As a function of the selected IF bandwidth, the corresponding equalizer is selected to process the appropriate discriminator output for both gain and video bandwidth. In addition, the equalizers inform the control unit of the operator selected IF bandwidth.

Field replacement or alteration of bandwidths can be accomplished merely by changing the desired filter and video equalizer. The FM video output of the equalizer is amplified to the proper level to drive the low impedance FM video output (J11). With both AM and FM video simultaneously available, an analog switch is used to select the desired video. Once selected, it is buffered and again amplified for the low

impedance video output (J13). A part of the selected video signal is tapped off and processed to become the line audio output (J12) and the head phone audio output available on the front panel.

Additional circuitry in the demodulator performs peak detection of both AM and FM video signals which the controller uses to perform AGC and AFC functions. The audio circuitry uses the pulse stretching circuitry to provide stretched audio to enhance the audible detection of pulse signals.

3.5.2 DETAILED DESCRIPTION

Assembly A11 consists of two circuit card assemblies (CCAs):

1. Detector CCA (A11A1)
2. Video Switcher CCA (A11A2)

Details of operation for each CCA are contained in the following subparagraphs. Figure 6-16 shows the inputs/outputs and interconnection of the CCAs.

3.5.2.1 Detector CCA (A11A1) P/N 659561-001

3.5.2.1.1 General

The detector CCA (A11A1) provides a total of seven outputs:

1. Switched IF to rear panel connector J10
2. AM Video to rear panel connector J8
3. Optional LOG Video to rear panel connector J9
4. LOG Video to video switcher CCA (A11A2)
5. AM Video to video switcher CCA (A11A2)
6. Wideband FM Video to video switcher CCA (A11A2)
7. Narrow Band FM Video to video switcher CCA (A11A2)

3.5.2.1.2 IF Processing

Refer to Figure 6-17, sheet 1 of 2, the left side of this schematic. The "AGC'D IF INPUT" signal at terminal E2 comes from the 160 MHz filter/gain module (A10) and is the IF signal which has been set for bandwidth and AGC level so it has a power level of approximately -30 dBm to +10 dBm at this point. It is coupled through dc decoupling capacitor C67 into power splitter U1.

At U1, the signal is split. One path of the IF signal goes to the AM detector circuitry, via C9 and CR2. The other path is to the limiter circuitry for eventual FM detection. Both paths are explained in detail.

In all modes, except CW, CR2 is turned on. Assuming that CR2 is conducting, the IF signal is then coupled through C10 to transformer T1. T1 is a dc buffer so that U3 and U4, which are ECL devices, can function and run at their appropriate operating voltages.

U3B and U3A serve as an amplifier/limiter to provide approximately 40 dB of gain. ECL devices operate at about one volt peak-to-peak at very high speed, wide bandwidth, and are inherently nonsaturating. This provides an excellent limiter circuit.

Resistors R21, R22, R15, and R16 provide the bias voltage for the input circuit. The output part of the amplifier provides the dc bias for the input. C17 and C18 decouple the signal on the output from the input. This is not negative feedback nor positive feedback, but is merely a bias voltage supply.

The output of U3A is coupled, via C19 and C20, to U4 which is operating essentially in the same mode as U3. One subtle difference is that R33 and R34 are lower in resistance than R25 and R26 to provide a better output power capability into output transformer T2. T2 is also a dc buffer.

The IF signal is then coupled, via C25 and RF amplifier U6 (a TO-5 configuration), into power splitter U5. U7 is an amplifier in the FM discriminator path out of U5. The other output of U5 is used for the linear detector circuits.

The second output of power splitter U1 is connected to power splitter U2. One output of U2 is the switched IF output at E4. This is the auxiliary IF output. It is bandwidth defined and gain adjusted either manually or via AGC and serves as a high-level IF output. As shown on Figure 6-1, sheet 2 of 2, this output goes through a -20 dB attenuator pad to rear panel connector J10.

The other output from U2 is connected, via delay line DL1, through a connector, to mixer U8 (see sheet 2 of 2, Figure 6-17). DL1 equalizes the time delay between that output of U2 and the output of power splitter U5. The output of U5 is also connected to U8.

3.5.2.1.3 AM Detection

U8 is a modern synchronous detector (mixer). The limited IF drives the mixer and switches the mixer diodes on and off at the carrier frequency rate. The amplitude information is carried on the line coming from DL1. Since the mixer diodes are being switched on and off, the conversion loss is low and defined. Therefore, the amplitude information going into the other port of the mixer is directly down converted to base-band frequency with very high dynamic range capabilities since the signal itself does not have to turn the diode on and off as in a normal diode type detector.

The output of U8 passes through a -3 dB attenuator comprised of resistors R45, R46, and R47. This attenuator provides a VSWR match by providing a 50-ohm load for the mixer.

The signal then passes through one of two low-pass filters selected by relay K1. K1 is operated by the 21.4/160 MHz signal at P1-1 of this CCA. The filter comprised of C34, C35, C36, and L9 and L10 is a 5 MHz filter used when 21.4 MHz is selected. The filter comprised of C37, C38, C39, L11, and L12 is a 50 MHz filter used when 160 MHz is selected.

Both filters remove the IF frequency (21.4 or 160 MHz) and pass the signal frequency from dc to 5 MHz or dc to 50 MHz, depending on the IF selected.

The filtered signal is amplified by video amplifier U15, which has a bandwidth from dc to 85 MHz and is capable of driving 50-ohm loads. Potentiometer R58 is used as a dc offset adjustment so that when no signal is present the output voltage is zero. U16 is a very low noise, very temperature stable input offset operational amplifier that is used to control the input current to U15 to maintain a very low dc offset and drift characteristic.

3.5.2.1.4 CW Mode

When in the CW mode (the CW mode is considered narrow bandwidth signals that are single sideband or double sideband, but with a suppressed carrier), with no carrier present, a carrier must be provided so mixer U8 can function properly. The 21.4-MHz beat-frequency-oscillator (BFO) mounted in the 21.4 MHz filter/converter module (A12) is turned on to provide the carrier signal. The BFO signal is connected to this module and appears at terminal E1. See Figure 6-17, sheet 1 of 2.

The BFO is used only for the 21.4-MHz IF or very narrow band signals. When the BFO is switched on, CR2 is turned off and CR1 is turned on, permitting the 21.4-MHz BFO signal to be fed through the limiting stages (consisting of the U3A, U3B, and U3C circuits) and into mixer U8 as the LO signal. The sideband information continues to travel through U1, U2, and DL1 to mixer U8. Amplitude information is provided from the normal signal and the LO signal is provided by the BFO.

Control of CR1 and CR2 is provided by U14A, which receives its input from video switch CCA (A11A2). Control of the low-pass/high-pass filter is done by transistors Q1 and Q2. See the left side of Figure 6-17, sheet 2. These transistors are driven by the 21.4/160 MHz signal from the video switcher CCA. When the signal is high, Q2 turns on energizing relay U13 and selecting the 21.4-MHz filter in the FM circuit: Q1 is off selecting the 5-MHz low-pass filter in the AM circuit. When the signal is low, the converse is true.

3.5.2.1.5 FM Demodulation

There are three different FM demodulator circuits:

1. A wideband circuit operating at 160 MHz
2. A medium band circuit operating at 21.4 MHz
3. A narrow band circuit operating at 21.4 MHz

The limited IF signal is provided by U7 (see Figure 6-17, sheet 1). The signal from U7 has two paths (see Figure 6-17, sheet 2, the left side and middle). This signal is switched by CR3/CR4 and CR13/CR14 into either the wideband or narrow band discriminator. Control of narrow band versus medium and wideband is performed by U14B.

When wide bandwidths are used, the signal goes through power splitter U10. At the output of U10, half of the signal goes through a -6 dB attenuator (R69, R70, and R71, serving as a buffer) into the L port (pin 8) of mixer U12. The other half of the signal out of U10 is coupled through C46 into diode switching (CR5 through CR12), controlled by U11A and B, to select between either 21.4 MHz and 160 MHz IFs.

If 160 MHz is used, the signal passes through delay line DL2. DL2 is set to have a 270° phase shift at 160 MHz. The signal appearing on the L-port (pin 8) of U12 and the 270°-shifted signal on the R-port of U12 (pin 1) are phase detected in U12.

As the signal changes in frequency above and below 160 MHz, the amount of phase shift, (±270°) through the delay line is recognized by U12. When the phase shift is exactly 270°, the output is zero; when it is greater than or less than 270°, the output is a + or - voltage.

When 21.4 MHz IF is selected, the signal is switched via DL3 (but it also goes through DL2). Since 21.4 MHz is a lower frequency and its wave length is significantly longer, the delay line must be much longer in order to realize 270° of phase shift.

C49 serves as a minor trimmer for DL3 so that the exact measurement of the delay line is not required. C52 serves as a fine trimmer for delay line DL2 at 160 MHz.

NOTE

Alignment of the 160-MHz discriminator must be accomplished before proceeding to align the 21.4-MHz discriminator.

When narrow bandwidths are selected, the signal is switched off by CR3 and CR4 and switched on by CR13 and CR14. The signal is coupled via C61 into crystal discriminator Y1. Y1 is used for only up to 300 kHz of bandwidth. It is a very temperature stable device providing very long quantities of phase shift necessary for the high output voltages required for narrow bandwidths in order to avoid dc drift problems. The output of the discriminator is amplified by video amplifier U22 and passed to the video switcher CCA (A11A2).

For wide bandwidths, the output of phase detector U12 is connected to relay K2 (see the left side of Figure 6-17, sheet 2) which provides selection of the IF filters as K1 did for the AM detector circuits.

With the 160-MHz IF selected, C53, C54, and L17 serve as a low-pass filter. This is a transitional filter since the input impedance is 50 ohms but the output impedance is very high.

With the 21.4-MHz IF selected, C55, C56, C57, L18, and L19 are selected and serve as a low-pass filter. Again, this is a transitional filter. The input capacitor and output capacitor are of unequal values since the input and output impedances are unequal.

The filtered video is amplified by U17, which is a dc to 85-MHz amplifier capable of driving low-impedance loads. Amplifier U18 is a very dc stable amplifier used to maintain low offset drift of video amplifier U17.

The dc offset can be adjusted with potentiometers R89 and R90:

1. When 160 MHz is selected, R89 is switched into the circuit and may be adjusted for the correct offset.

2. When 21.4 MHz is selected, R90 is switched into the circuit and provides the necessary offset adjustment.

Narrow band offset adjustment is done using potentiometer R97.

Standard AM video output is provided from this CCA. Resistor R102 (see the upper right side of Figure 6-17, sheet 2) serves as a 51 ohm source impedance. If 75-ohm impedance is required, R102 must be changed to 75 ohms.

With the optional LOG video, the output of the LOG detector is connected to this CCA at E5. Some of the signal is provided to the video switcher CCA (A11A2). If 75 ohms impedance is required, R101 must be changed to 75 ohms.

Voltage regulators (see Figure 6-17, sheet 1) VR1 and VR2 provide highly-regulated +12 and -12 volts dc for the dc offset adjustments.

3.5.2.2 Video Switcher CCA (A11A2), P/N 659565-001

Refer to Figure 6-18. Wideband and medium band FM video and narrow band FM video are provided to this CCA from the detector CCA (A11A1). The wideband FM video is connected to J2-6 (see the upper left of the schematic) and the narrowband FM video is connected to J2-4 (see the bottom left of the schematic). Wideband and medium band FM video goes to pin 21 on each of the equalizers (EQ1 through EQ8). Narrow bandwidth FM video (300 kHz or less) goes to pin 19 of the equalizers.

The equalizers (EQ1 through EQ8) are used for three purposes:

1. providing attenuation of the video signal, thus setting the proper output voltage versus bandwidth for any particular selected filter bandwidth;

2. providing low-pass filters to provide video bandwidth equal to one-half of the IF bandwidth; and

3. providing signals necessary for the microprocessor to know what bandwidths are present in the receiver.

The video output from each equalizer is on pin 12. One of relays K1 through K8 is selected as a function of which bandwidth has been selected. The closed contacts of the selected relay connect the signal to U7, which is a video amplifier/line driver. U7 has dc compensation provided by U8. An FM offset is provided by the microprocessor via J1-16. R41 and R51 (on the output line from U7) provides a source impedance to drive 50-ohm loads. R41 and R51 would be changed to 150 ohms if 75 ohms is required. This line is connected to rear panel connector J11.

A 160-MHz reference oscillator is mounted in the tuner. This reference signal can be switched into the IF chain and thus provide a center-frequency calibration for use for determining the output voltage, which the microprocessor can measure and provide compensation by way of the FM offset.

Resistor R42 and capacitor C28 comprise a low-pass filter to provide FM information to the microprocessor for signal centering purposes.

A peak-detector circuit, comprised of U13A and U13B and associated components, measures the overall deviation of the FM signal. This information may prove valuable, to a WJ-8969 system user, for signal identification. Analog switch U12 provides the dump function for the peak-detector circuit. U12 is operated by digital signals from the microprocessor.

Video select functioning and audio output circuits are contained in U11 and associated components. Video selection can choose from standard AM or linear video, or LOG video, or FM video. Analog switch U14 provides the video selection.

One portion of U14 selects either linear video (AM/CW) or LOG video to go to Q1, CR1, and U9A. These elements provide a peak-detector circuit. This circuit is subject to temperature drift so transistor Q2, CR2, and U9B provide a temperature compensation matching. The output of U9A and U9B are connected to amplifier U10, which is an additional peak-detector circuit. Q1 and CR1 comprise a very high-speed peak detector, which has a relatively finite decay time. U10 drives diode CR4 and charges capacitor C19, which can store the peak information for a very long time period.

The quality of rise time of the signal versus store time is a figure of merit of peak detectors. Very long store time-to-rise time ratio is very difficult to achieve. This circuit, by virtue of being split into first a high-speed peak detector and then a long hold peak detector, provides this very high ratio hold time to rise time.

Analog switch U12 also provides a dump function for the peak-detected signal held in C19. The other half of U14 then selects between the AM video and FM video to go into amplifier U11. U11 is a very wideband video amplifier capable of driving low impedance lines. Resistors R18 and R57 comprise a voltage divider and a 50-ohm output source impedance.

Audio output is provided as both line audio and phones audio outputs. The line audio goes to rear-panel connector J12. The phones audio is connected to the IFC unit motherboard and ultimately through an amplifier and gain control to a front panel head-phone jack. Since audio can be selected for either listening to FM or standard type AM signals or pulse transmissions, a method of selecting an audio stretcher is provided.

Analog switch U15 selects between the switched video, which is unstretched, or the prestretched AM video coming from U9A. Therefore, the audio can be either unstretched for listening to FM or standard AM transmissions or stretched when listening to pulse-type transmissions.

Equalizers EQ1 through EQ8, besides controlling analog functions, provide necessary information for the functioning of the filter assemblies and the microprocessor.

The microprocessor provides select functions performed with the IF select, BW SEL 1, BW SEL 0 control lines (J1-10, 9, and 8). The microprocessor selects EQ1 through EQ8 with these control lines. These lines control analog switches U5 and U4 (see the left side of the schematic). When the appropriate code is present, one of eight possible outputs is switched on in these analog switches.

U5/section-A provides a +5-volt signal that goes to one of eight outputs as a function of the microprocessor selection. The output (through VS1 to VS8) is used in two places:

1. It goes to relay driver U6 which selects the one of eight relays to switch the appropriate video output:

2. It goes to pin 1 of the selected equalizer.

The signal is routed by the presence or absence of diodes on the equalizer to the outputs appearing on pins 24 and 23. When an equalizer serves for a 21.4-MHz filter, the diode is inserted between pin 1 and pin 24, thus providing a +5 volt signal on pin 1 of J2. When a narrowband discriminator function under 300 kHz is required, a diode is connected between pin 1 and pin 23, thus providing a TTL high on pin 2 of J2.

In addition, the +5 volts appearing on pin 1 is divided by resistors mounted on the equalizer to provide output voltages on pins 2, 3, and 4 of the equalizer. The voltages on these pins are a function of the bandwidth for which the equalizer has been programmed. These output voltages return to U5 section B and to U4 sections A and B. The appropriate voltages are then selected and appear on J1-5, -6, and -7 as bandwidth codes 0, 1, and 2.

This coded information in the form of voltages is returned to the microprocessor where it is measured by the microprocessor to know for what bandwidth a particular equalizer has been programmed. Thus, the microprocessor selects an equalizer. The equalizer then tells the microprocessor what bandwidth it is.

Every equalizer must be accompanied by an associated filter. You can change the receiver's bandwidth by changing equalizer and filter, but filter and equalizer must be changed as a pair. The filters are mounted in the 160 MHz filter/gain module (A10) and the 21.4-MHz filter/converter module (A12).

The 21.4/160 MHz signal also appears on J1-22. This signal is used to control the 160-MHz filter/gain module (A10) and the 21.4-MHz filter/converter module (A12). Control of the CW function on the detector board is routed through the video switcher CCA from J1-4 to J2-3.

3.6 FRONT PANEL DISPLAY (A1), P/N 659480-001

Refer to Figure 6-19. The Front Panel Display Board contains the 24-character LED display and the LEDs for mode indication and status of the WJ-8969 IFC. It consists of six 4-digit LED displays, one address decoder (U12), a four-digit segment display controller chip (U7), and three LED packs (U9, U10, and U11).

The 24-character LED display is made of six (U1 through U6) 7-segment displays. A character is latched into one of the four registers in one of the HPDL-2416s depending on the two LSB bits of the address. The next three more significant address bits determine which of the six (U1-U6) is written to. This is done with decoder (U12) driving the chip enables to the HPDL-2416s.

All six of these ICs have a square wave for the blank input which is used to control the intensity by varying the duty cycle, thus changing the on/off ratio of the character. This variable square wave comes from the Front Panel Interface CCA (A3).

The cursor is set to be on a specific character location simply by setting the MSB bit of the ASCII data high at write time. This bit is low on the write for noncursor character locations. When the cursor enable line from the Front Panel Interface CCA (variable square wave) is low, the character is displayed; when the enable line is high, the cursor is displayed.

The tuning bar LEDs; the COR, AGC, AFC, and REM LED; and the tune lock LED are all driven by U7. This device stores up to four words and will sequentially pulse the data for each. The tuning bar word (one bit per spot on the bar) and the word with on/off information of the COR, AGC, AFC, REM, and Tune Lock LEDs, and the words with keypad Key Active LEDs are all saved in a register determined by the LSB bits of the address bus.

U7 then cycles through the data, sequentially presenting the data and the corresponding one of four digit enable lines. These four lines each enable the corresponding set of LEDs. When the Tuning Bar data is present, D3 goes high, thus saturating to ground Q2 which lets the LEDs in U9 indicate the data. When the COR, AGC, AFC, REM, and Tune Lock data is present, D4 goes high and Q1 saturates, enabling LEDs CR1 and U10 and U11.

Similarly, D1 and D2 are active for Key Active LEDs located on the Front Panel Keyboard CCA. In all cases, when the appropriate D1-D4 line is active, the LEDs with high data in will light; those with low data in will be off.

3.7 FRONT PANEL KEYBOARD (A2), P/N 659484-001

Refer to Figure 6-20. This CCA is a 4 x 5 array of pushbuttons of which nine have LEDs in them. The Front Panel Interface CCA (A3) with the U5 chip (see Figure 6-21), sequentially pulls each of the four X-axis lines low. This way, when a switch is pushed, one of the five Y-axis lines will go low when the correct X-axis line is low. U5 will then encode the X and Y axis into a switch identity as described in paragraph 3.8.

The nine switches with LEDs are driven by the U7 on the Front Panel Display CCA (A1). All LEDs except the SHIFT key LED are driven when DLA is ground (corresponds to D1 of U7 high), the shift key is driven when DLB is at ground (D2 of U7 high). An LED will light if the data is high when the appropriate DLA or DLB is ground.

3.8 FRONT PANEL INTERFACE (A3), P/N 659490-001

Refer to Figure 6-21. This board controls the front panel LED display and reads the pushbuttons and the tuning wheel. It consists of the front panel display write circuit including the two 74HC373s (U1 and U3) and the 74LS123 dual one shot (U2); the keypad encoder and read circuit including the 74C923 (U5) and 74HC365 (U4); the cursor blink rate control and display intensity circuit including the 7556 timer (U6); and the shaft encoder circuit including 74HC86 (U9), 74HC14 (U8), and 74HC74 (U7).

In order to write the display message for the front panel LEDs, the ASCII data and the character address (1880H to 1897H) present on the data bus and address bus are latched into U1 and U3 by chopping the front panel write pulse with one shot U2A. The second half of the dual one shot (U2B) delays the write pulse and its output pulse is used to strobe the data that has been latched into the U1 and U3 to the display driver ICs on the Front Panel Display Driver CCA (A1).

The keypad pushbuttons are encoded by the keyboard encoder 74C923 (U5). U5 sequentially pulls each of the four X-axis lines low. If a key is pressed, the Y-axis line will go low when the sequence pulls the appropriate X-axis line low. This X-Y relation will identify the pressed switch. When any key is pushed, pin 13 (Data Available) goes active high and indicates the interrupt condition. The encoded switch identity is latched in the IC and can be read by enabling the outputs of buffer (U4) onto the data bus by reading address 1880H.

The cursor blink rate is varied by adjusting R7. This will change the frequency of the 7556 timer (U6A). Since R6 is small compared to R8 plus pot R7, the duty cycle will remain at about 50% as the cursor blink rate changes. As R7 is turned in a clockwise direction, the blink rates slow

down. The display intensity is varied by adjusting R4. This will change both the duty cycle and the frequency of 7556 timer (U6B). As the R4 is turned clockwise, the display will get brighter.

The shaft encoder generates two square waves offset by 90 degrees when it is turned. In one direction, output A leads B and in the other direction, output A lags B. After the pulses are inverted by the 74HC14 (U8), they feed XOR gates (U9A and U9B). The R-C circuit slows down the pulses, so the inputs to the XOR gates will change at different times since one is delayed and the other is not.

When shaft encoder outputs A and B change levels, the inputs to the XORs will be at different levels briefly, output pin 3 pulses every time A changes level, and the output at pin 6 will pulse every time shaft encoder output B changes level. Both these outputs feed a third XOR gate (U9C) so that output pin 8 will give a pulse every time either A or B changes level. This pulse feeds the clock inputs of flip flop (U7) whose input is the invert of shaft out B (U7), as well as driving the interrupt circuit on the IEEE-488/Interrupt CCA (A8).

The output of the flip flop is XORed with the inverted A output of the shaft encoder. If A leads B, then the output of the XOR (U9D) will be low. If A lags B, then the output of the XOR will be high. This gives the direction of rotation of the shaft encoder.

3.9 CONTROL MOTHER BOARD (A4), P/N 659496-001

Refer to Figure 6-22. This board primarily interconnects all the digital CCAs in the WJ-8969 IFC. The Microprocessor CCA (A5), the Analog Interface CCA (A6), the Digital Interface CCA (A7), and the IEEE-488/Interrupt CCA (A8) all plug into connectors on the Mother Board. J1 connects to the audio pot and phone jack on the front panel. J2 connects to the Front Panel Interface CCA (A3). J3 connects to the tuning wheel. J4 connects to the A9 module. J5 connects to the A10 module. J6 connects to the A11 module. J7 connects to the A12 module. J8 connects to rear panel connector J2. J9 connects to the A14 module. J10 is the power input for the digital CCAs. J11 is the serial tuner data link. J12 powers the front panel.

This board (A4) also contains some audio circuitry. The audio signal comes in J6 from the Demod module (A11). It passes through R4 and goes to analog switch DG300CJ (U2) where it is either passed on or grounded by the squelch line from the Digital Interface CCA (A7).

The squelch line is activated through the COR signal. The squelched audio goes to J1 where it is sent to the top of the front panel audio gain pot. The wiper of the pot (the bottom is ground) comes back in J1 and feeds the noninverting input of MC1458 op-amp (U1). The output of this op-amp goes out J1 to the tip of the phones jack. The sleeve of the jack is grounded.

3.10 MICROPROCESSOR (A5), P/N 659589-001

Refer to Figure 6-23. The Microprocessor Board consists of the MC68809 microprocessor, 27256 EPROMs, HM6264LF RAM, reset circuit, address decoding, and address and data bus buffers.

The MC68B09 (U5) is an 8-bit microprocessor with 64K usable address range. The 4.9152 MHz crystal (Y1) sets the E clock used by the system to run at approximately 1.25 MHz. Power-up is done by holding reset low several E clock cycles. When 5 volts Vcc is turned on, Q2 will saturate to near 5 volts and become Vcc to the 6264 RAM and the 74000 (U20). The diodes CR4 and CR5 will open the circuit to the battery. The time required to charge up capacitors C3, C4, and C16 causes reset to be held low by the 74C00 (U20). When 5 volts is turned off, Q2 cuts off and the battery provides Vcc to RAM and U20. There are two types of interrupt in a 6809. The FIRQ is a task interrupt and is driven by the multitasker timer on the IEEE/Interrupt board. The normal interrupt, IRQ, is driven by IEEE-488 communication, tuner UART communication, pushbuttons, and by the tuning wheel.

The system software is located in the 27256 EPROMs (U7 and U9). U7 contains software from address 0000-017FF hex and 4000-7FFF hex. U9 contains software from address 8000-FFFF hex. System stack and RAM is located in the 6264 RAM (U11) along with the scan, step, and lockout cell information. This occupies addresses 2000-3FFF hex. The remaining addresses, 1800-1FFF hex are reserved for hardware interfacing. The memory mapping just described is done in 27LS19 PROM (U1) using the five MSB address lines.

Before being used to drive I/O, the address bus is buffered with 74HC244s (U12 and U13) and the data bus is buffered in and out with the 74HC245 (U19).

3.11 ANALOG INTERFACE BOARD (A6), P/N 659501-001

Refer to Figure 6-24. The Analog Interface Board is used to control the four attenuators, set the FM offset and monitor various analog inputs including AM video, AM peak detector, FM video, and BW codes. The board consists of the 16 into one IH6116CP analog MUX, the AD574A analog to digital converter, 74HC138 decoder, 74HC374 latch, and three AD528 DACs.

Analog inputs are monitored by first selecting an input with the analog MUX (U8), by writing the select code to the 74HC374 latch at address 1C0F hex, then starting the convert by strobing address 1C00 hex, then testing for End Of Convert signal, and then reading the digitized value from the A/D at address 1C00 hex. The op-amp U7 is used to increase gain and thus widen the usable data range read from the A/D converter.

Attenuator voltages and the FM offset voltage are set by writing eight-bit numbers to the DACs at hex addresses as follows: attenuator A at 1C08, attenuator B at 1C09, attenuator C at 1C0A, attenuator D at 1C0B, and the FM offset at 1C0D.

3.12 DIGITAL INTERFACE BOARD (A7), P/N 659505-001

Refer to Figure 6-25. The Digital Interface Board is used to send and receive serial data from the tuner and output digital information to the RF modules. It consists of two MC68B50 UARTs, three 74HC374 latches, a 74HC138 decoder, and a CD4040 baud rate generator.

Tuner communication is done serially using the 68B50 UART (U10) and 75140 line receiver and op-amp U7. Data is loaded in parallel to the UART by the microprocessor data bus when transmitting and read in parallel when receiving data. The tuner UART and its internal registers occupy addresses 1C06 and 1C07, with the later address the transmit and receive register.

Digital signals out from address 1A01 (U13) include the 3-bit BW select code to select one of eight bandwidths, bypass mode bit, narrowband filter bit, CW, FM, and LOG video select bits. Outputs at address 1AC0 (U14) include dump peak detector, audio squelch, stretch audio, and IF spectrum invert.

Digital inputs at address 1A0C hex include IF freq (21.4 or 160 MHz), and several spares. UART U11 is spare and can be set at various baud rates using DIP switch S1 and baud rate generator U6.

3.13 IEEE-488/INTERRUPT BOARD (A8), P/N 659509-001

Refer to Figure 6-26. The IEEE-488/Interrupt Board is used to interface to the IEEE-488 bus and drive the interrupt circuitry. It consists of the IEEE interface including the MC68B488, 75160, and 75161, FIRQ circuit with 4020 counter and 74HC74, and the interrupt circuit including the 145C68, 74C174 and 74C373.

The IEEE-488 interface is controlled by the MC68B488 (U13) and transceivers U6 and U7. The GPIA controller (MC68B488) occupies addresses 19C0 through 19C7 hex. The IEEE address is read from switch S2 through 74C373 (U10) at address 19C4 hex using the address enable of the GPIA controller. System options can be read at this address and at address 1900 from switch S1 through 74C373 (U9).

The FIRQ timer (U1) is set to give an interrupt every 3.33 msec. All of the interrupt sources named in the discussion of the microprocessor board are combined through AND gate array (U14). The individual source can be determined by reading the IRQ status word at address 1800 hex through 74C373 U15. Individual interrupts can be disabled at the hardware level by writing to IRQ mask register (74C174 U16) at address 1800 hex.

The FIRQ interrupt is cleared by writing to address 1905 hex. The IEEE-488 IRQ is cleared by reading the interrupt status register in the MC68B488 at address 19C0 hex. Front Panel key interrupts are cleared by writing to address 1902 hex. Tuning wheel interrupts are cleared by writing to address 1900 hex. Tuner UART interrupts are cleared by wiring to address 1904 hex.

CHAPTER IV

MAINTENANCE

4.1 GENERAL

The WJ-8969/IFC IF Demodulator and Controller Unit has been designed to operate for extended periods of time with minimum routine maintenance. Inspection and performance tests should be conducted at regular intervals consistent with the facility's normal scheduling and after troubleshooting. No routine adjustments are required. Troubleshooting and performance tests can be most effectively carried out if the technician first familiarizes himself with the the operating instructions and circuit descriptions in Sections II and III, respectively. Parts lists and component location diagrams are in Section V.

4.2 INSPECTION FOR DAMAGE OR WEAR

Many potential or existing troubles can be detected by making a visual inspection of the unit. For this reason, a complete visual inspection should be made on a regular basis and whenever the unit is inoperative. Components showing signs of deterioration should be checked and a thorough investigation of the associated circuitry should be made to verify proper operation. Damage due to overheating may be the result of other less apparent troubles in the circuit. It is essential that the cause of overheating be determined and corrected before replacing the damaged parts. Mechanical parts such as pin connectors and chassis wiring should be inspected for excessive wear, looseness, misalignment, corrosion, and other signs of deterioration.

4.3 COMPONENT LOCATION

Every component in the receiver can be located by using the component location diagrams found in Section V. The component location diagrams are listed according to their reference designation prefix and can be found using the List of Illustrations in the front of the manual. For further instruction on reference designations, see paragraph 5.1.

4.4 REPAIR

When a malfunction has been isolated to a specific circuit board or assembly, the user may decide to make the repair himself or return the board or assembly to the factory for replacement or repair. Some of the modules can be removed entirely, while in other cases only boards can be removed. The entire front panel can be removed as a unit.

4.5 PREVENTIVE MAINTENANCE

This unit is designed to operate for extended periods of time with minimum maintenance. Normally, the only preventive maintenance tasks to consider are:

1. Clean the unit.
2. Inspect the outside and inside of the unit for physically worn, damaged, loose, or overheated parts.
3. Perform a performance check of the unit.

If the equipment is used in an environment where a great deal of dust, high temperature, or high humidity is present, the frequency of the checks should be increased. Table 4-1 provides the maximum time intervals between equipment cleaning and performance checks.

4.5.1 EXTERIOR CLEANING

Remove loose dirt accumulated on the outside of the unit with a moist paper towel, cloth, or brush. The brush is good for removing dirt on and around the front panel controls. Dirt and grease which is not removed can be cleaned off with a paper towel or cloth made moist with a detergent and water solution. Do not use an abrasive cleaner.

Table 4-1. Preventive Maintenance Schedule

PM Action	Schedule
Cleaning outside of equipment	Every two months or when dust is seen on the surface of the equipment.
Cleaning inside of equipment	Every four months or when dust gets into the equipment.
Looking for damage or wear to parts of the equipment	When the inside of the equipment is cleaned or the unit is not operating properly.
Unit performance test	Every six months, individually, or as a part of an overall system test, or at other times if it is suspected the unit is not operating properly.
Unit performance tests	After equipment has been repaired.

4.5.2 INTERIOR CLEANING

Dust on the inside of the unit should be removed as it may hold tiny conductive particles or it may cause electrical circuit parts to overheat. The best way to clean the inside is to blow it out gently with a nondestructive, low-pressure air stream. An alternative is to vacuum the dust off using a small brush to loosen the dirt.

4.6 GENERAL MAINTENANCE

Many failures can be detected by looking at the circuit boards and wiring. A complete inspection of the unit should be made during the cleaning operation for signs of mechanical and electrical failures. A change in the color of a part due to an overheated condition is usually an indication of a problem area in the equipment. Mechanical parts, including front panel control connectors, should be checked for wear, loose connections, bad alignment, or other possible causes of defective operation. Worn parts should be replaced and loose panel controls tightened. Check for loose cable connections, and tighten those connectors. Ensure that all circuit boards are held tightly in their receptacle.

After a repair has been made, alignment should be carried out, if necessary, and appropriate performance tests should be used to verify proper operation.

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 larger than 40 Watts, and a solder sipper or wicking procedure should be employed when removing solder. Noncorrosive soldering flux should be used when removing solder by wicking. In returning components to the board, make sure the holes are clear and be careful that the 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. Heat no longer than is necessary to achieve a good joint. A heat sink should be used where possible.

4.7 IFC PERFORMANCE TESTS

4.7.1 GENERAL

This performance test procedure may be used for initial inspection, periodic checks, or to confirm performance specifications after repairs have been made. These tests should be carried out only by skilled technicians using the equipment listed in Table 4-2. If receiver problems exist while performing these tests, troubleshoot the appropriate module, subassembly, or circuit. When performing these tests, the technician should follow the guidelines below.

Table 4-2. Test Equipment Required

	Name	Manufacturer	Model No.
1.	Synthesized Signal Generator	Hewlett-Packard	8673C
2.	Synthesized Signal Generator	Hewlett-Packard	8662A
3.	Power Meter	Hewlett-Packard	436A
4.	Frequency Counter	Hewlett-Packard	5340A
5.	Oscilloscope	Tektronix	7704A
6.	Spectrum Analyzer	Hewlett-Packard	8566B
7.	Noise Figure Meter	Hewlett-Packard	8970A
8.	Noise Diode	Hewlett-Packard	346A
9.	Function Generator	Wavetek	166
10.	Computer	Hewlett-Packard	9826
11.	Pulse Generator	Hewlett-Packard	8112A
12.	Digital Voltmeter	Dana	4700A
13.	White Noise Generator	Wandel and Goltermann	RS-25
14.	White Noise Receiver	Wandel and Goltermann	RE-25

1. Read each paragraph carefully from beginning to end before attempting to perform the test described in the paragraph.

2. All tests are to be performed under the following environmental conditions unless otherwise specified:

Temperature	+25°C ±5°C (77°F ±9°F)
Humidity	Room ambient

3. All test equipment shall be allowed a warm-up period of at least 15 minutes before the start of any test.

4. All inputs to and outputs from the equipment under test which are not in use during any particular test are to be terminated with their characteristic impedances.

5. All equipment covers must be in place unless a particular test requires their removal.

Tests on the IF Demodulator/Controller (IFC Unit) are performed on the largest BW centered on 21.4 MHz (if Option AA is installed) and on the largest IF BW centered on 160 MHz (not bypass). Note the IF bandwidths on the appropriate test specifications tables. Select any operational tuner for tests that require a tuner.

4.7.2 TEST EQUIPMENT REQUIRED

The test equipment listed in Table 4-2 or equivalents are required for performing corrective maintenance. All the equipment, however, is not used in any one test.

When an equipment is not available, its equivalent may be used provided the equipment meets or exceeds the specifications of the replaced equipment.

4.7.3 POWER UP

When the IF Demodulator/Controller (IFC Unit) is initially powered up, it runs a self test to check for any faults in the system. Error messages are displayed in the unit's alphanumeric display describing any errors that may be present. (These errors will be checked in paragraph 4.8.2, Bite Test.) Also during power on, the unit runs a calibration program that sets IF gain (if a tuner is connected) and all individual gains for each installed IF BW filter.

The unit will power up with a message "8969 MICROWAVE RECEIVER" and then a flashing message "TUNER NOT RESPONDING" if a tuner is not connected to the unit. All LEDs and key lights will light up for a short duration and then the key lights will go off and some of the LEDs will remain on.

To disable the "TUNER NOT RESPONDING" message, press MENU key, then press INC key until the message "ERROR DISPLAY MENU" appears. Press ENTER key and the message "ENABLE TUNER ERRORS YES" will appear. Press DEC key to indicate NO, then press MENU key again. The "TUNER NOT RESPONDING" message will no longer be displayed.

After all error checking and calibration is complete (which takes about five seconds) the unit should be in the following mode of operation:

FREQUENCY*	1000.000 MHz (with a flashing "*" on the 10 MHz digit)
COR	On
AGC	On
AFC	Off
REM	Off
TUNE LOCK	Off
TUNE	Center
IF BW	BYP
DET MODE	AM
COR LVL	00
SIG STR	<-80
Tuning Rate	10 MHz
Key Lights	All Off
Mode	Manual

*The frequency displayed is the bottom edge frequency of the receiver.

Unless otherwise specified, the front panel controls shall be set as above with the AGC off and the RF ATTN set to 00 for all tests in this section. Verify power-up operation on Table 4-3.

4.7.4 FRONT PANEL FUNCTIONAL CHECKS

Verify operation of each of the following controls on the IFC Unit. Use Table 4-3 for verification.

Table 4-3. Verification for Power-Up and Front Panel Checks

POWER-UP	_____
FRONT PANEL FUNCTIONAL CHECKS	
Tuning Wheel	_____
INC, DEC	_____
ENTER	_____
SHIFT	_____
DEL	_____
COR LEVEL	_____
RF ATTN	_____
IF BW	_____
TUNE RATE	_____
TUNE LOCK LED	_____
FREQ	_____
AGC	_____
AFC	_____
DET MODE	_____
LOCAL	_____
MENU	_____
MEM	_____
STORE	_____
EXEC	_____
MAN	_____
SCAN	_____
STEP	_____
LKOT	_____

4.7.4.1 Tuning Wheel

The tuning wheel increases (CW rotation) or decreases (CCW rotation) the tuned frequency.

4.7.4.2 INC, DEC Keys

The INC and DEC keys allow incrementing and decrementing of certain values and answering yes or no to questions. Depressing and holding down the INC or DEC keys will continuously repeat the operation.

4.7.4.3 ENTER Key

ENTER key is used primarily to enter numeric values selected from the keyboard. Other functions require the ENTER key as a utility function key and are specifically mentioned when discussing these functions.

4.7.4.4 SHIFT Key

Pressing the SHIFT key lights the LED on the key and sets the unit in shift mode. The functions colored in red on the top part of the keys (numbers 0 through 9, decimal point, DEL and LKOT) are accessible only in the shift mode.

To execute entries made in the shift mode the ENTER key must be pressed. Erroneous entries made while in the shift mode can be erased by pressing the DEL key before pressing the ENTER key.

4.7.4.5 DEL Key

This key is active when the SHIFT key is pressed and acts as a correction key for the numeric keypad. In the shift mode, the numeric keys are active for setting frequency, RF ATTN, COR Level, etc. The DEL key simply cancels the last action for corrections. This key may be pressed as many times as necessary to make the correction before pressing the ENTER key.

4.7.4.6 COR LEVEL Key

Pressing the COR LEVEL key lights the LED on the key and the COR indicator light on the front panel display may be on or off. The COR Level is displayed on the front panel with a flashing "*" and can now be changed with the INC or DEC keys. If the INC or DEC key is held down, it will auto-repeat. There is wraparound from "--" (off condition) to "00" (on condition) or vice versa, but wraparound will stop auto-repeat. The INC or DEC key must be released and held down again to resume auto-repeat.

To enter a COR level using the numeric keys, press the SHIFT key then enter a COR Level using the 0 through 9 numeric keys, then press the ENTER key. Upon pressing the ENTER key, the COR LEVEL and SHIFT key lights will be extinguished. If a number greater than "60" is entered, the display will show "--". This means the entry is out of limits.

4.7.4.7 RF ATTN Key

Pressing the RF ATTN key lights the LED on the key and the RF Attenuation in dB appears on the front panel display with a flashing "*" replacing the IF BW display. The attenuation can now be changed with the INC or DEC keys if the AGC is off. If the INC or DEC key is held down it will auto-repeat. There is no wraparound. The attenuation will stop at 99 (maximum) or stop at 00 (minimum).

To enter an attenuation level using the numeric keys, turn off AGC, press the RF ATTN key, press the SHIFT key, enter an attenuation level using the 0 through 9 numeric keys, then press the ENTER key. Upon pressing the ENTER key, the RF ATTN and SHIFT key lights will be extinguished and the RF Attenuation display will return to IF BW display.

4.7.4.8 IF BW Key

Pressing the IF BW key lights the LED on the key and the IF Bandwidth value appears on the front panel display with a flashing "*" followed by K for (kHz) or M for (MHz) or BYP for (bypass). The IF BW can now be changed with the INC or DEC keys. There is no wraparound.

4.7.4.9 TUNE RATE Key

Pressing the TUNE RATE key lights the LED on the key and a message "TUNING RATE=" appears along with a flashing "*" on the frequency display. Pressing the INC key increases the tuning rate by powers of ten up to 1000 MHz and back down to 0. Pressing the DEC key decreases the tuning rate by powers of ten down to zero and back up to 1000 MHz.

If the tuning rate is set to zero, the TUNE LOCK indicator light comes on and the Tuning Wheel and INC and DEC keys are disabled for frequency tuning purposes. Frequency can then be only entered through the numeric keypads.

To enter a tune rate using the numeric keys, press the SHIFT key then enter a tune rate using the 0 through 9 numeric keys (including the decimal point) then press the ENTER key. Upon pressing the ENTER key, the TUNE RATE and SHIFT key lights will be extinguished.

4.7.4.10 FREQ Key

Pressing the FREQ key lights the LED on the key and the frequency can be incremented or decremented by the INC or DEC keys by the tune rate selected. There is no auto-repeat. The frequency is displayed on the front panel in MHz with a resolution to 1 kHz.

To enter a frequency using the numeric keys, press the SHIFT key then enter a frequency using the 0 through 9 numeric keys (including the decimal point), then press the ENTER key. Upon pressing the ENTER key, the FREQ and SHIFT keys lights will be extinguished.

4.7.4.11 AGC Key

Pressing the AGC key turns the AGC mode on or off and the indicator light on or off on the front panel display. With the AGC turned off, the signal strength readout display is replaced by % usage of AM detector.

4.7.4.12 AFC Key

Pressing the AFC key turns the AFC mode on or off and turns the AFC indicator light on or off on the front panel display.

4.7.4.13 DET MODE Key

Pressing the DET MODE key causes the unit to cycle to the next detection mode in the sequence: AM, FM, CW (if Option AA is installed) and PS (Pulse) which is displayed under the DET MODE on the front panel display. Holding the DET MODE key down will allow continuous cycling.

In CW Detection mode, the IF BW will go to the largest IF BW centered on 21.4 MHz if the previous BW has a 160 MHz center frequency. If the previous BW has a 21.4 MHz center frequency, there will be no change. When Pulse Detection mode is selected, the BW will go to the BW that was set in FM Detection Mode if, in CW Detection Mode, the BW was changed. Pulse Detection will turn off AFC. AM Detection will restore AFC if it was deactivated by Pulse Detection.

4.7.4.14 LOCAL Key

This key turns the receiver in and out of remote/local mode. When in remote mode, the REM indicator light on the front panel display lights and the only active functions are the LOCAL key and the AUDIO LEVEL control. When in local mode, the unit is controlled by the front panel controls.

4.7.4.15 MENU Key

Pressing the MENU key displays the name of the first sub-menu. Pressing the INC or DEC keys causes the displays of the next or preceding sub-menu. Pressing the ENTER key causes the unit to enter the displayed sub-menu. Perform the following exercises to verify operation of each sub-menu.

4.7.4.15.1 SCAN SEGMENT Menu

The scan segment sub-menu is a means of entering information in a scan memory channel by answering a series of questions. This information can also be entered by manually setting the receiver parameters appropriately using the front panel controls.

1. Press MENU key. The message "SCAN SEGMENT MENU" will be displayed.

2. Press ENTER key. The message "CHANNEL NUMBER" will be displayed. The channel numbers 00 through 58 can be entered by the INC or DEC keys or by the numeric keypads.

3. Press ENTER key. The message "START FREQ" will be displayed. The frequency can be entered by the tuning wheel or by the numeric keypads.

4. Press ENTER key. The message "STOP FREQ" will be displayed. The frequency can be entered by the tuning wheel or by the numeric keypads.

5. Press ENTER key. The message "IF BANDWIDTH" will be displayed. The IF BW can be changed by the INC or DEC keys.

6. Press ENTER key. The message "DETECTION MODE" will be displayed. The Detection Mode can be changed by the DET MODE key.

7. Press ENTER key. The message "COR LEVEL" will be displayed. The COR level can be entered by the INC or DEC keys or by the numeric keypads.

8. Press ENTER key. The message "AGC OPTION YES" will be displayed. DEC key sets query to NO and INC key sets query to YES.

9. Press ENTER key. The message "AFC OPTION NO" will be displayed. DEC key sets query to NO and INC key sets query to YES.

10. Press ENTER key, then press MENU key. This will return the unit to Manual mode.

4.7.4.15.2 SCAN/STEP OPTIONS Menu

The scan/step options menu allows the operator to determine what action is to be taken when a signal is found when scanning or stepping.

1. Press MENU key and then press INC key until the message "SCAN/STEP OPTIONS MENU" is displayed.

2. Press ENTER key. The message "MULTI SEQUENCE SCAN NO" will be displayed. DEC key sets query to NO and INC key sets query to YES.

3. Press ENTER key. The message "QUEUE SIG - DON'T STOP NO" will be displayed. The INC and DEC keys are used as in step 2.

4. Press ENTER key. The message "HOLD AFTER SIG GONE NO" will be displayed. The INC and DEC keys are used as in step 2.

5. Press ENTER key. The message "HOLD AFTER ONE PASS NO" will be displayed. The INC and DEC keys are used as in step 2.

6. Press ENTER key. The message "DETECT LEADEDGE ONLY NO" will be displayed. The INC and DEC keys are used as in step 2.

7. Press ENTER key. The message "HOLD IF QUEUE FULL NO" will be displayed. The INC and DEC keys are used as in step 2.

8. Press ENTER key. The message "HALF BW SCAN NO" will be displayed. The INC and DEC keys are used as in step 2.

9. Press ENTER key. The message "FULL BW SCAN NO" will be displayed. The INC and DEC keys are used as in step 2.

10. Press ENTER key. The message "SCAN INCREMENT" will be displayed if steps 8 and 9 are both set to NO. The frequency increment from 1 kHz to 100 MHz can be entered by the numeric keypads.

11. Press MENU key. This will return the unit to manual mode.

4.7.4.15.3 CONFIGURATION Menu

This menu allows the operator to set step and lockout channels and remote interface addresses.

1. Press MENU key and then press INC key until the message "CONFIGURATION MENU" is displayed.

2. Press ENTER key. The message "FIRST STEP CHANNEL" will be displayed. The channel number can be entered by the INC or DEC keys or by the numeric keypads.

3. Press ENTER key. The message "FIRST LOCKOUT CHANNEL" will be displayed. The channel number can be entered by the INC or DEC keys or by the numeric keypads. The IFC will power-up with Channel No. 60.

4. Press ENTER key. The message "REMOTE INTERFACE ADDR" will be displayed. The address number 00 through 30 can be entered by the INC or DEC keys or by the numeric keypads. The IFC until will power-up with what the remote (DIP) switch inside the IFC unit is set to.

5. Press MENU key. This will return the unit to manual mode.

4.7.4.15.4 ERROR DISPLAY Menu

Unless disabled, error messages are displayed on the alphanumeric display when associated errors occur. This menu is a convenient way to reexamine these messages and also to disable them.

1. Press MENU key and then press INC key until the message "ERROR DISPLAY MENU" is displayed.

2. Press ENTER key. The message "ENABLE TUNER ERRORS YES" will be displayed. DEC key sets query to NO and INC key sets query to YES.

3. Press ENTER key. The message "ENBL HARDWARE ERRORS YES" will be displayed. The INC and DEC keys are used as in step 2.

4. Press ENTER key. The message "HARDWARE ERRORS FOLLOW" will be displayed.

5. Press ENTER key. The message "TUNER NOT RESPONDING" will be displayed.

6. Press ENTER key. If there are no more errors, the display will be blank.

7. Press MENU key. This will return the unit to manual mode.

4.7.4.15.5 Frequency Queue Menu

This menu allows the operator to display the frequencies intercepted in the Scan or Step mode. Fifteen frequencies can be stored and once the frequencies are displayed they will be erased from memory.

1. Press MENU key and then press INC key until the message "FREQUENCY QUEUE MENU" is displayed.

2. Press ENTER key. The message "FREQUENCY" will be displayed.

3. Press ENTER key again to display other intercepted frequencies.

4. Press MENU key. The MENU key will return the unit to Manual mode.

4.7.4.16 MEM Key

Pressing the MEM key lights the LED on the key and places the unit in the examine memory mode. In this mode the display shows the parameters stored in the selected memory channel. The type of channel (indicated by either S for scan channels or T for step channels or L for

lockout channels) and the channel number along with a flashing "*" appears in the display in place of the signal strength readout. The channel number can be changed with the INC or DEC keys or by the numeric keypads.

When the MEM key is pressed, the message "CHANNEL DISABLED" will be displayed. To enable the channel, press the SHIFT key and then press the LKOT key. The message should disappear and the channel should be enabled. To disable the channel, repeat the process.

The parameters stored in the channel can be changed with the parameter keys and tuning wheel in the same manner as when the unit is in the Manual mode.

4.7.4.17 STORE Key

Pressing this key causes the message "ENTR TO STORE MEMORY" to be displayed along with the current memory channel. The channel number can be selected with the INC or DEC keys or by the numeric keypads. If the ENTER key is pressed while in this mode, the unit's parameters are stored in the selected channel.

The IFC unit contains a battery pack to save the memory contents if the unit is turned off. To check the batteries, store various parameters into several memory channels. Turn unit off for 15 minutes. Turn unit back on and verify that the memory stored is still intact.

To verify the CLEAR memory function, turn unit off. Hold the DEL/EXEC down while turning the power back on to the unit. The unit will power up as in paragraph 4.7.3 but the first message displayed will be "POWER UP MEMORY CLEAR ON" indicating the memory has been cleared. Verify that the memory stored has been cleared.

Another way to CLEAR memory is to enter the Configuration Menu. In the Configuration Menu, change a parameter and press the MENU key. The unit will display "CLEARING MEMORY." This should clear all memory.

4.7.4.18 EXEC Key

While the MEM key is lighted, pressing the EXEC key changes the unit's parameters to those stored in the selected memory channel and sets the IFC unit to the Manual mode.

4.7.4.19 MAN Key

This key activates the manual mode of operation when the receiver is in the automatic mode. This allows manipulation of current automatic mode parameters or change of control. If the MAN key is pressed while the unit is scanning or stepping, it sets the unit to scan-pause or step-pause state. In this state, the unit's parameters may be changed. If the MAN key is pressed again, it returns the unit to manual mode.

4.7.4.20 SCAN Key

This test requires a tuner to be connected to the IFC unit.

When the SCAN key is pressed, it lights the LED on the key and puts the unit in scan armed state. The message "ENTER TO START SCAN" is displayed along with the current memory channel number with a flashing "*". The channel number may be changed with the INC or DEC keys or by the numeric keypads.

If the ENTER key is pressed while in this state, the SCAN key remains lighted and the unit starts scanning from the frequency in the selected memory channel to the frequency in the next higher numbered channel. In this state, the display shows the start frequency, the message "SCAN", and the stop frequency. If Multi Sequence Scan is enabled in the Configuration Menu, the unit will scan from the first scan memory channel to the memory channel selected. The display will show "SCAN" and the start and stop frequency currently being scanned.

While the unit is scanning and the MAN key is pressed, the unit goes to scan-pause state. The SCAN key light flashes on and off and the unit's parameters can be changed in this state. If the MAN key is pressed again, the SCAN key light will turn off and the unit will return to the Manual mode. If the SCAN key is pressed instead of the MAN key, then the unit will continue scanning.

Initially, the scan channels are set for 00 through 29 (identified by a letter designation of S) but these may be changed to other channels through the Configuration Menu. The scan channel parameters may be entered manually or they can be entered through the Scan Segment Menu. The type of scan desired can be set through the Scan/Step Options Menu. These operations are checked in paragraph 4.8.3.

4.7.4.21 STEP Key

This test requires a tuner to be connected to the IFC unit.

When the STEP key is pressed, it lights the light on the key and puts the unit in step-armed state. The message "ENTER TO START STEP" is displayed along with the current step channel number with a flashing "*". The channel number may be changed with the INC or DEC keys or by the numeric keypads.

If the ENTER key is pressed while in this state, the STEP key remains lit and the unit starts stepping from the first step channel through all enabled step channels up to the selected step channel.

When stepping, the unit sets itself to the parameters stored in the step channels. In this mode, the display shows the message "STEPPING."

While the unit is stepping and the MAN key is pressed, the unit goes to step-pause state. The STEP key light flashes on and off and the unit's parameters can be changed in this state. If the MAN key is pressed again, the STEP key light will turn off and the unit will return to Manual mode.

Initially, the step channels are set for 30 through 59 (identified by a letter designation of T), but these may be changed to other channels through the Configuration Menu. The step channel parameters may be entered using the STORE key or they can be entered through the Scan Segment Menu. The type of step desired can be set through the Scan/Step Options Menu. These operations are checked in paragraph 4.8.3.

4.7.4.22 LKOT Key

To enter the lockout state, press the SHIFT key, then press LKOT key. The front panel will display the message "ENT-TO LO." In this first lockout state, the lockout frequency and IF bandwidth is entered. The lockout frequency can be entered by the tuning wheel or by the numeric keypads. The IF BW can be changed by the INC or DEC keys.

Press SHIFT key and then press LKOT key. Press SHIFT key and LKOT key again. The front panel will display the message "LO START FREQ." In this second lockout state, the start frequency is entered. The start frequency can be entered by the tuning wheel, INC or DEC keys or by the numeric keypad. Press ENTER key. The front panel will display the message, "LO STOP FREQ".

In this third lockout state, the stop frequency is entered. The STOP frequency can be entered by the tuning wheel, INC or DEC keys or by the numeric keypad. Press ENTER key. The unit should return to manual mode.

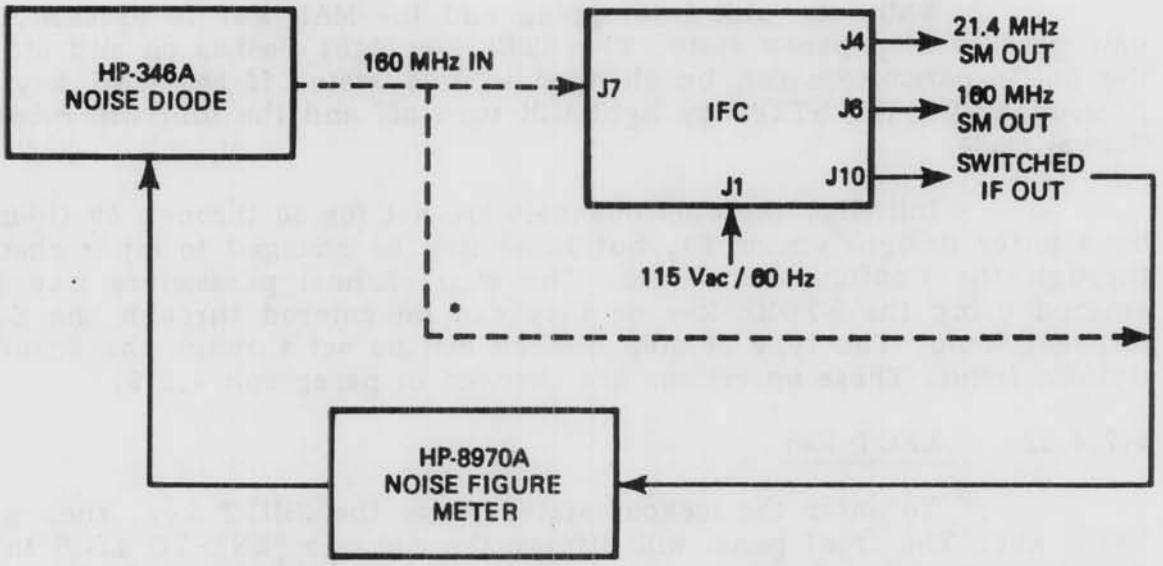
Another function of the LKOT key is to enable or disable a memory channel. While the MEM key is lit, pressing the SHIFT key, then the LKOT key, will enable the channel. Repeating the process will disable the channel.

Initially, the lockout channels are set for 60 through 99 (identified by a letter designation of L) but these may be changed to other channels through the Configuration Menu. Further operation of the lockout function is checked in paragraph 4.8.3.

4.7.5 NOISE FIGURE, RF/IF GAIN

1. Connect equipment as shown in Figure 4-1.

2. Calibrate noise figure meter as follows:



*WHEN CALIBRATING NOISE FIGURE METER, CONNECT NOISE DIODE TO THE NOISE FIGURE METER AS SHOWN.

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Figure 4-1. Noise Figure, RF/IF Gain Test Setup

Enter: 1.3
Press: SPECIAL FUNCTION
Press: START FREQ
Enter: 160 MHz
Press: STOP FREQ
Enter: 160 MHz
Enter: 3.0
Press: SPECIAL FUNCTION
Enter: 21.4 MHz or 160 MHz
Press: SMOOTHING (DECREASE or INCREASE button) until "smoothing" = 8
Press: CORRECTED NOISE FIGURE AND GAIN
Connect noise diode to the noise figure meter input.
Press: CALIBRATE
The noise figure meter should now be calibrated.

3. Connect noise diode to the IF input and set noise figure meter to 160 MHz.

4. Read and record the noise figure and RF/IF Gain at the (J6) 160 MHz SM Out.

5. Select the largest IF BW centered on 160 MHz. Read and record the noise figure and RF/IF Gain at the J10 Switched IF Out.

6. Repeat steps 2 through 5 for the 21.4 MHz Out (if Option AA is installed). Take measurements at the (J4) 21.4 MHz SM Out and (J10) Switched IF Out.

7. Use Table 4-4 to enter test data.

4.7.6 SIGNAL MONITOR OUTPUTS

1. Connect equipment as shown in Figure 4-2.

2. Tune synthesized signal generator to 160 MHz CW and set its output, as measured at the IF input, to -10 dBm.

3. Measure and record the frequency and the power out at the (J6) 160 MHz SM Out using a frequency counter and power meter.

4. Connect a spectrum analyzer to the (J6) 160 MHz SM Out. Set spectrum analyzer to storage mode and vary the signal generator frequency up and down from its initial setting to display the -3 dB points of the IF passband on the spectrum analyzer.

5. Measure and record the upper and lower -3 dB points of the passband. Calculate and record the -3 dB BW by subtracting the lower -3 dB point from the upper -3 dB point.

6. Measure and record the passband ripple. Subtract the value of the deepest valley from the value of the highest peak found within the -3 dB points of the passband and record this value as ripple in dB.

7. Repeat steps 1 through 6 for the (J4) 21.4 MHz SM Out, if Option AA is installed.

8. Table 4-5 gives the specifications for this test.

Table 4-4. Noise Figure and RF/IF Gain Data Record

Output	IF BW	Noise[1] Figure (dB)	RF/IF[1] Gain (dB)
160 MHz SM OUT	X		
Switched IF Out (160 MHz)			
21.4 MHz SM OUT	X		
Switched IF Out (21.4 MHz)			

[1]For information only.

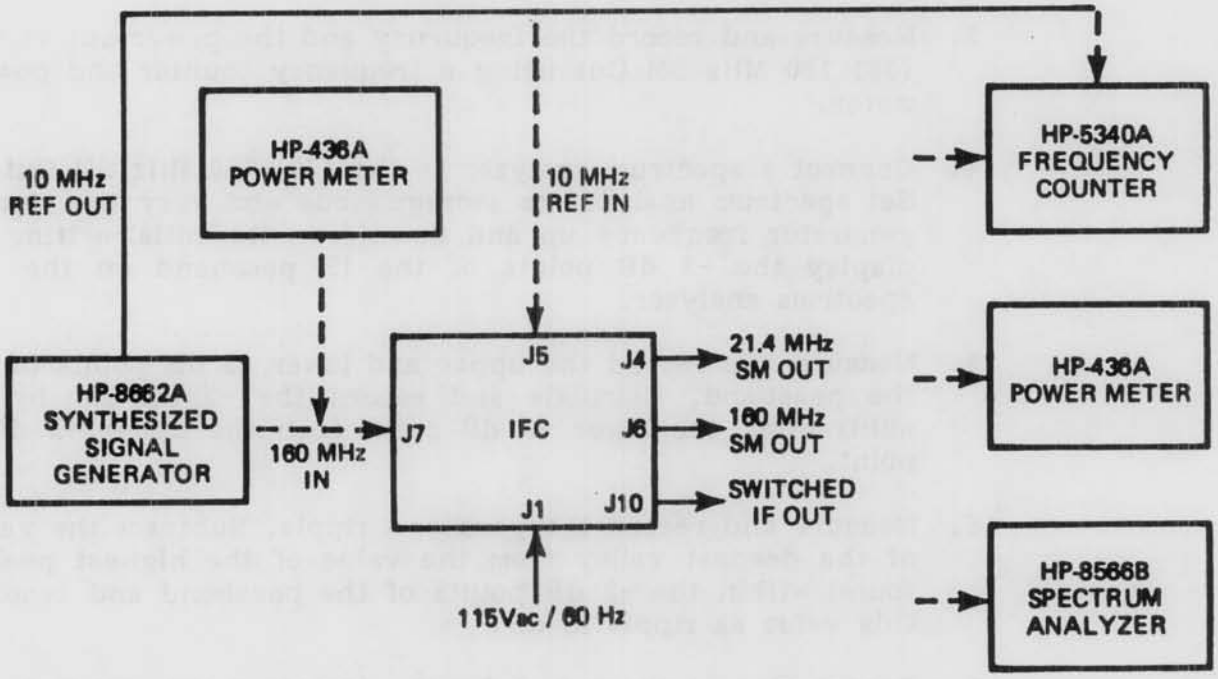


Figure 4-2. Signal Monitor Outputs, RF Attenuation, and AFC Operation Test Setup

Table 4-5. Signal Monitor (SM) Outputs Test Specifications

Output	Frequency[1] (MHz)	Power Out[1] (dBm)
21.4 MHz Out		
160 MHz Out		

Output	-3 dB Upper Frequency (MHz)	-3 dB Lower Frequency (MHz)	-3 dB Bandwidth (MHz)	Spec Min (MHz)	Bandpass Ripple (dB)	Spec Max (dB)
21.4 MHz Out				8		3
160 MHz Out				40		3

[1]For information only.

4.7.7 TANGENTIAL SENSITIVITY (PULSE DETECTION)

1. Connect equipment as shown in Figure 4-3. On the IFC unit, select Pulse Detection Mode and BYP IF BW.
2. Set synthesized signal generator to 160 MHz, pulse modulated at 1 usec PW, 1 kHz PRI.
3. Connect an oscilloscope to the (J13) Selected Video Out. Adjust signal generator input power level until the pulse is tangential to the noise floor of the IFC. Record this input power level on Table 4-6 as tangential level.
4. Repeat step 3 for the remaining IF BWs centered on 160 MHz.
5. Repeat steps 1 through 4 for the IF BWs centered on 21.4 MHz if Option AA is installed.
6. Table 4-5 gives the specifications for this test.

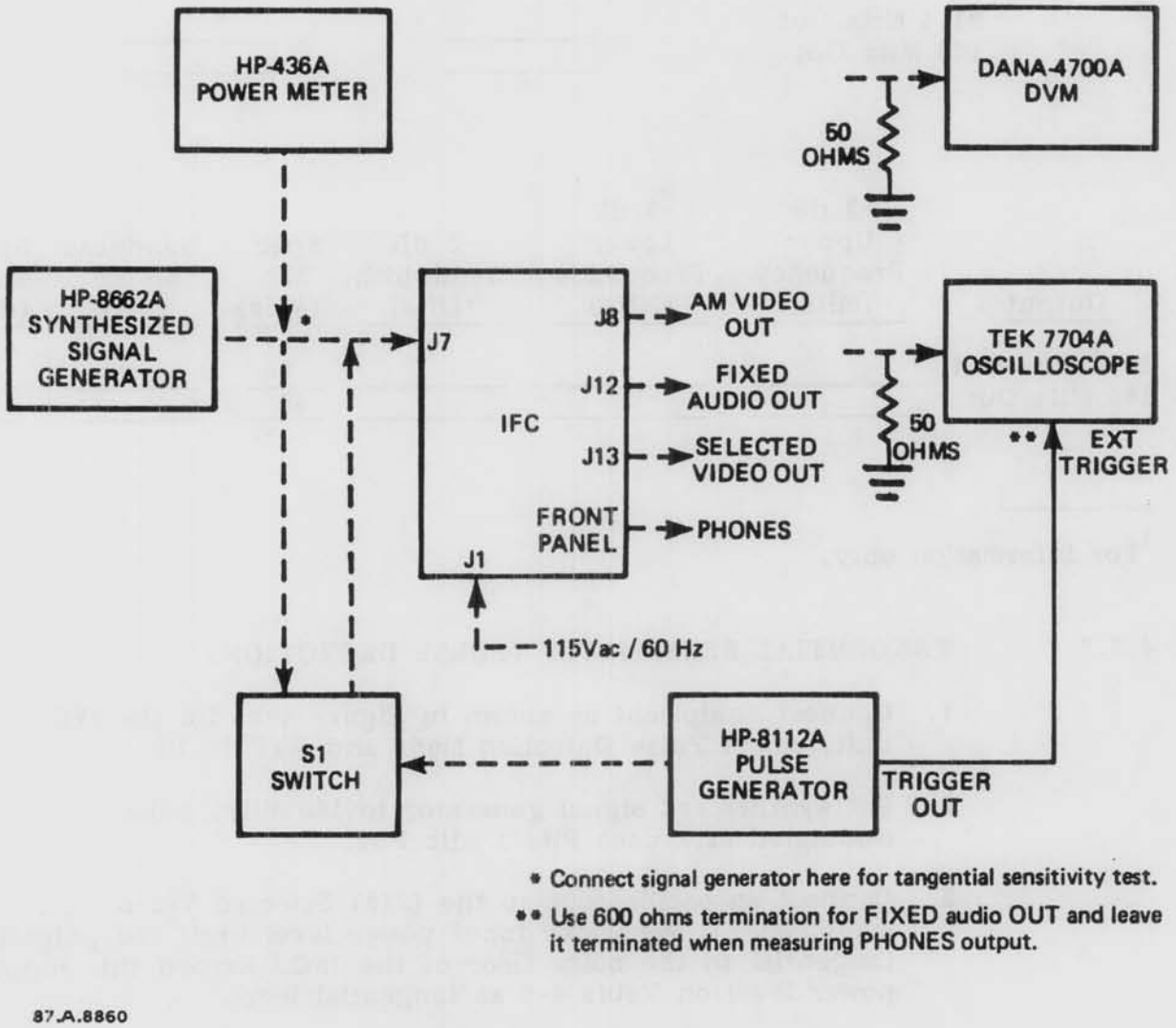


Figure 4-3. Tangential Sensitivity, CW Detection, Audio Outputs, AM Video, AGC Operation, and FM Outputs Test Set-up

Table 4-6. Tangential Sensitivity (Pulse Detection) Specifications

Output	IF BW	Input Level[1] for Tangential (dBm)
Selected Video Out (160 MHz)	BYP	
Selected Video Out (21.4 MHz)		

[1]For information only.

4.7.8 CW DETECTION

Perform this test only if Option AA is installed.

1. Connect equipment as shown in Figure 4-3. On the IFC unit, select CW Detection Mode and the largest IF BW centered on 21.4 MHz.
2. Set synthesized signal generator to 160.001 MHz CW, -50 dBm level.
3. Connect an oscilloscope to the (J8) AM Video Out. Measure and record the output frequency. Record on Table 4-7.
4. Vary the signal generator frequency up and down from its original setting and note that the AM Video Out frequency varies up and down in equal increments. Record on Table 4-7.
5. Repeat steps 2 through 4 for (J13) Selected Video Out.
6. Table 4-7 gives the specifications for this test.

Table 4-7. CW Detection Test Specifications

Output	IF BW	Output Frequency (kHz)	Spec Max (kHz)
AM Video Output	____	_____	1 ±0.3
Selected Video Out	____	_____	1 ±0.3

Video Out frequency
varies with input frequency: AM Video Output ____ ( )
Selected Video Out ____ ( )

4.7.9 RF ATTENUATION

1. Connect equipment as shown in Figure 4-2. On the IFC unit select largest IF BW centered on 160 MHz and 00 RF ATTEN.
2. Input a -80 dBm CW signal to J7.
3. Set spectrum analyzer to 2 dB/div, 2 MHz span, 160 MHz center frequency, and center the IF signal on the display.
4. Increase the RF attenuation by 10 dB and increase the input power by 10 dB.
5. On the spectrum analyzer, measure the change in signal amplitude. (Example: If the signal is 2 dB higher than the last reading the change is -2 dB.)
6. Record on Table 4-8.
7. Repeat steps 3 through 6 for the remaining RF attenuation settings on Table 4-8.
8. Table 4-8 gives the specifications for this test.

Table 4-8. RF Attenuation Test Specifications

RF ATTN	Error (dB)	Spec Max (dB)
10	_____	±3.5
20	_____	±3.5
30	_____	±3.5
40	_____	±3.5
50	_____	±3.5
60	_____	±3.5
70	_____	±3.5
80	_____	±3.5
90	_____	±3.5

4.7.10 AFC (Automatic Frequency Control) OPERATION

NOTE

To perform this test, the IFC unit must be powered-up without a tuner connected.

1. Connect equipment as shown in Figure 4-2. On the IFC unit, select AFC on and the largest IF BW centered on 160 MHz.
2. Set synthesized signal generator to 160 MHz CW, -30 dBm.
3. The Tune HI-LO indicator LED bar should be at center. As the input frequency is increased, the LED bar indicator should advance toward HI. As the input frequency is decreased, the LED bar indicator should advance toward LO. Record the input frequency for each LED bar as indicated on Table 4-9.
4. If Option AA is installed, repeat steps 2 and 3 for the largest IF BW centered on 21.4 MHz.

4.7.11 AUDIO OUTPUTS

NOTE

Use 600 ohms termination for PHONES output and 50 ohms termination for Fixed Audio Out. Leave the Fixed Audio Out terminated when measuring PHONES out.

Table 4-9. AFC (Automatic Frequency Control)

Tune LED Indicator Bar	160 MHz IF BW _____ Input[1] Frequency (MHz)	21.4 MHz IF BW _____ Input[1] Frequency (MHz)
HI		
3rd		
2nd		
1st		
CENTER		
1st		
2nd		
3rd		
LO		

[1]For information only.

1. Connect equipment as shown in Figure 4-3. On the IFC unit, select AM Detection Mode, AGC on, and the largest IF BW centered on 160 MHz.

2. Set synthesized signal generator to 160 MHz, 95% AM modulated at 1 kHz rate, and -30 dBm level.

3. With an oscilloscope, measure and record the peak-to-peak output voltage at (J12) Fixed Audio Out. Repeat this step with the modulation depth set at 10%.

4. On the IFC unit, set AUDIO LEVEL to max (CW rotation). Set the signal generator to 95% AM modulation.

5. With an oscilloscope, measure and record the peak-to-peak output voltage at the PHONES output. Repeat this step with the modulation depth set at 80%, 60%, 40%, 20%, and 10%.

6. Set the modulation depth to 95%. Vary the AUDIO LEVEL from max to min and verify that the PHONES peak output voltage decreases. Record results on Table 4-10.

7. If Option AA is installed, repeat steps 1 through 6 for the largest IF BW centered on 21.4 MHz.

Table 4-10. Audio Outputs Data Record

	IF BW	Modulation Depth	Fixed Audio[1] Out (p-p volts)
160 MHz	_____	95%	_____
		10%	_____
21.4 MHz	_____	95%	_____
		10%	_____

Modulation Depth	160 MHz IF BW _____ Phones Out[1] Max Gain (p-p volts)	21.4 MHz IF BW _____ Phones Out[1] Max Gain (p-p volts)
95%	_____	_____
80%	_____	_____
60%	_____	_____
40%	_____	_____
20%	_____	_____
10%	_____	_____

AUDIO LEVEL Pot. Operation _____ ( )

_____

[1]For information only.

4.7.12 AM VIDEO OUTPUTS

1. Connect equipment as shown in Figure 4-3. On the IFC unit, select AM Detection Mode and the largest IF BW centered on 160 MHz.

2. Set synthesized signal generator to 160 MHz, 95% AM modulated at 1 kHz rate and -30 dBm level.

3. Enable the AGC then disable the AGC.

4. With an oscilloscope, measure and record the peak-to-peak output voltage at the (J13) Selected Video Out and the (J8) AM Video Out. Record the AM% modulation displayed on the front panel of the IFC unit.

5. Repeat step 3 for the remaining AM modulation depths indicated on Table 4-11.

6. If Option AA is installed, repeat steps 1 through 5 for the largest IF BW centered on 21.4 MHz.

4.7.13 AGC (Automatic Gain Control) OPERATION

1. Connect equipment as shown in Figure 4-3. On the IFC unit, select AM Detection Mode, AGC on, and largest IF BW centered on 160 MHz.

2. Set synthesized signal generator to 160 MHz CW and a power level where the AGC is just activated by observing when RF Attenuation changes from 00.

3. With an oscilloscope, measure and record the output voltage at the (J13) Selected Video Out. Increase the signal generator input power by 10 dB until the AGC is ineffective.

   At each 10 dB power increase, measure and record the Selected Video Out voltage and the input power level. At the end of the test, record (on Table 4-12) the RF ATTEN as displayed on the IFC unit.

4. Repeat step 3 for (J8) AM Video Out.

5. If Option AA is installed, repeat steps 1 through 4 for the largest IF BW centered on 21.4 MHz.

6. On the IFC unit, select Pulse Detection Mode, AGC on, and largest IF BW centered on 160 MHz.

7. Repeat steps 2 through 5.

4.7.14 -3 dB IF BANDWIDTH

1. Connect equipment as shown in Figure 4-4.

2. Input a synthesized -30 dBm CW signal tuned to 160 MHz. On the unit select BYP IF BW and turn AGC on, then turn AGC off.

3. Set spectrum analyzer to storage mode, 160 MHz center frequency, 1 dB/div and a frequency span of 1-1/2 times the bandwidth being measured.

4. Vary the signal generator frequency up and down from its initial setting until the -3 dB points of the IF passband are displayed on the spectrum analyzer.

Table 4-11. AM Video Outputs Data Record

AM Modulation Rates

160 MHz IF BW _____

Modulation Depth	AM% Modulation Display	Selected[1] Video Out (p-p volts)	AM Video Out[1] (p-p volts)
95%			
80%			
60%			
40%			
20%			
10%			

21.4 MHz IF BW _____

Modulation Depth	AM% Modulation Display	Selected[1] Video Out (p-p volts)	AM Video Out[1] (p-p volts)
95%			
80%			
60%			
40%			
20%			
10%			

Table 4-12. AGC (Automatic Gain Control) Operation Data Record

CW

Power Increase (dB)	160 MHz IF BW _____ Selected[1] Video Out (peak volts)	160 MHz IF BW _____ AM Video[1] Video Out (peak volts)	21.4 MHz IF BW _____ Selected[1] Video Out (peak volts)	21.4 MHz IF BW _____ AM Video[1] Out (peak volts)
0				
+10				
+20				
+30				
+40				
+50				
+60				
+70				
+80				
RF ATTEN[1]	_____ dB		_____ dB	

PULSE

Power Increase (dB)	160 MHz IF BW _____ Selected[1] Video Out (peak volts)	160 MHz IF BW _____ AM Video[1] Out (peak volts)	21.4 MHz IF BW _____ Selected[1] Video Out (peak volts)	21.4 MHz IF BW _____ AM Video[1] Out (peak volts)
0				
+10				
+20				
+30				
+40				
+50				
+60				
+70				
+80				
RF ATTEN[1]	_____ dB		_____ dB	

[1]For information only.

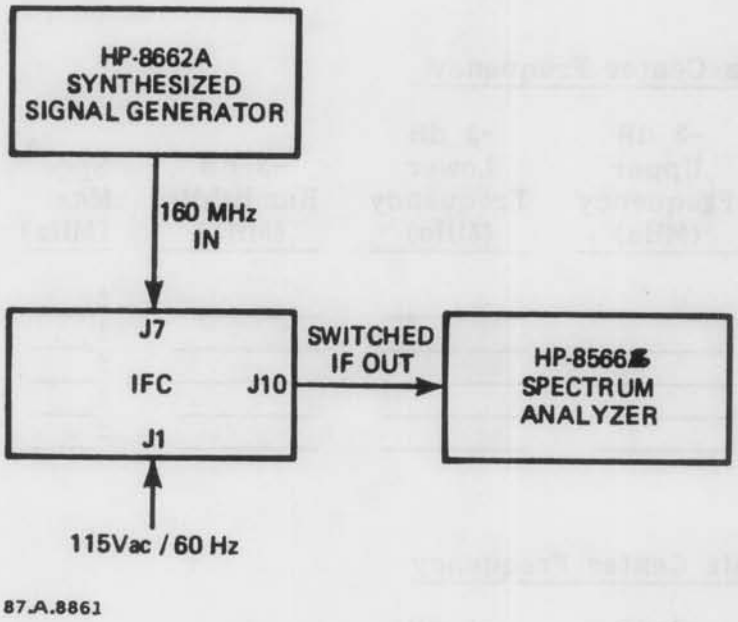


Figure 4-4. -3 dB IF Bandwidth Test Set-up

5. Measure and record the upper and lower -3 dB points of the passband as displayed on the spectrum analyzer. Calculate and record the -3 dB bandwidth by subtracting the lower -3 dB point from the upper -3 dB point. Record on Table 4-13.

6. Measure and record the bandpass ripple. Subtract the value of the deepest valley from the value of the highest peak found within the -3 dB points of the passband and record this value as ripple in dB.

7. Repeat steps 2 through 6 for the remaining IF bandwidths centered on 160 MHz.

8. If Option AA is installed, repeat steps 2 through 7 for the IF BWs centered on 21.4 MHz.

Table 4-13. -3 dB IF Bandwidth Test Specifications

160 MHz Center Frequency

IF[1] Bandwidth (MHz)	-3 dB Upper Frequency (MHz)	-3 dB Lower Frequency (MHz)	-3 dB Bandwidth (MHz)	Spec[2] Max (MHz)	Bandpass Ripple (dB)	Spec Max (dB)
BYP				±		3
				±		3
				±		3
				±		3
				±		3

21.4 MHz Center Frequency

IF[1] Bandwidth (kHz)	-3 dB Upper Frequency (kHz)	-3 dB Lower Frequency (kHz)	-3 dB Bandwidth (kHz)	Spec[2] Max (kHz)	Bandpass Ripple (dB)	Spec Max (dB)
BYP				±		3
				±		3
				±		3
				±		3
				±		3

[1]Record the IF BWs installed in the IF Demodulator/Controller.

[2]Calculate and record IF BW spec as: ±15% X IF BW selected.

4.7.15 FM OUTPUTS

1. Connect equipment as shown in Figure 4-3. On the IFC unit, select FM Detection Mode and the largest IF BW centered on 160 MHz.
2. Set synthesized signal generator to 160 MHz CW, -30 dBm.
3. Connect a voltmeter to the (J13) Selected Video Out. Measure and record the peak output voltage at the Selected Video Out for the input frequencies indicated on Table 4-14.
4. Repeat step 3 for (J11) FM Video Out.

Table 4-14. FM Outputs (Linearity) Test Specifications

160 MHz IF BW _____

Input[1] Frequency (MHz)	Selected Video Out (peak volts)	FM Video Out (peak volts)	Spec Selected Out/ FM Out (peak volts)
			-1.0 ± 0.1/-0.5 ± 0.05
160			0 ± 0.1/0 ± 0.05
			+1.0 ± 0.1/ +0.5 ± 0.05

21.4 MHz IF BW _____

Input[1] Frequency (MHz)	Selected Video Out (peak volts)	FM Video Out (peak volts)	Spec Selected Out/ FM Out (peak volts)
			-1.0 ± 0.1/-0.5 ± 0.05
160			0 ± 0.1/0 ± 0.05
			+1.0 ± 0.1/ +0.5 ± 0.05

[1]Take measurements at ten equal increments over the IF BW Selected from 160 MHz + 1/2 BW to 160 MHz - 1/2 BW.

5. Repeat steps 3 and 4 for the remaining IF BWs centered on 160 MHz but for these, measure and record the peak output voltage at the center frequency and the upper and lower -3 dB limit frequencies of the IF BW selected. Record on Table 4-15.

6. If Option AA is installed, repeat steps 1 through 5 for the IF BWs centered on 21.4 MHz.

7. Tables 4-14 and 4-15 give the specifications for this test.

4.7.16 REMOTE CONTROL

1. Connect equipment as shown in Figure 4-5.

2. Load the WJ disk (P/N 199711) into the HP-9826 computer. Set the IFC to REMOTE control and verify the IFC unit is set for device code005.

3. Operate the HP-9826 and the IFC Unit accordingly to verify proper operation of the following commands. Record on Table 4-16. Section II (2.4.8.4) details the commands.

Commands	Description
AFC	Turn on AFC.
AFC/	Turn off AFC.
AFC?	What is the state of AFC?
AGC	Turn on AGC.
AGC/	Turn off AGC.
AGC?	What is the state of AGC?
AM	Turn on AM Detection Mode.
AM?	What is the AM modulation?
BWC?	What is the bandwidth (in MHz)?
BWn	Select BWn (1 through 8).
BW?	What bandwidth is selected (1 through 8)?
CER	Clear all errors.
CHNn	Enable memory channel n.
CHN/n	Disable memory channel n.
CHNn?	Is memory channel n enabled?
CLC	Clear all lockout channels.
CLLf	Clear lockout at frequency f (in MHz).
CLM	Clear all memory and initialize the unit.

Table 4-15. FM Outputs (Gain) Test Specifications

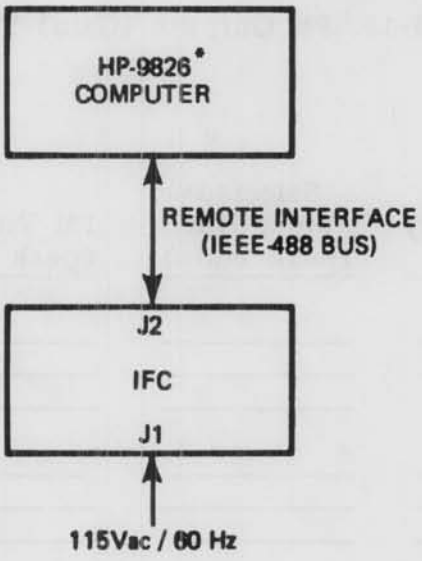
160 MHz IF BW

IF BW (MHz)	Input[1] Frequency (MHz)	Selected Video Out (peak volts)	FM Video Out (peak volts)	Selected Out/ FM Out (peak volts)
____	____ 160 ____	____ ____ ____	____ ____ ____	-1.0 ± 0.1/-0.5 ± 0.05 0 ± 0.1/0 ± 0.05 +1.0 ± 0.1/+0.5 ±0.05
____	____ 160 ____	____ ____ ____	____ ____ ____	-1.0 ± 0.1/-0.5 ± 0.05 0 ± 0.1/0 + 0.05 +1.0 ± 0.1/+0.5 ± 0.05
____	____ 160 ____	____ ____ ____	____ ____ ____	-1.0 ± 0.1/-0.5 ± 0.05 0 ± 0.1/0 ± 0.05 +1.0 ± 0.1/+0.5 ± 0.05
____	____ 160 ____	____ ____ ____	____ ____ ____	-1.0 ± 0.1/-0.5 ± 0.05 0 ± 0.1/0 ± 0.05 +1.0 ± 0.1/+0.5 ± 0.05

21.4 MHz IF BW

IF BW (MHz)	Input[1] Frequency (MHz)	Selected Video Out (peak volts)	FM Video Out (peak volts)	Selected Out/ FM Out (peak volts)
____	____ 160 ____	____ ____ ____	____ ____ ____	-1.0 ± 0.1/-0.5 ± 0.05 0 ± 0.1/0 ± 0.05 +1.0 ± 0.1/+0.5 ±0.05
____	____ 160 ____	____ ____ ____	____ ____ ____	-1.0 ± 0.1/-0.5 ± 0.05 0 ± 0.1/0 + 0.05 +1.0 ± 0.1/+0.5 ± 0.05
____	____ 160 ____	____ ____ ____	____ ____ ____	-1.0 ± 0.1/-0.5 ± 0.05 0 ± 0.1/0 ± 0.05 +1.0 ± 0.1/+0.5 ± 0.05
____	____ 160 ____	____ ____ ____	____ ____ ____	-1.0 ± 0.1/-0.5 ± 0.05 0 ± 0.1/0 ± 0.05 +1.0 ± 0.1/+0.5 ± 0.05

[1] Take measurements at 160 MHz + 1/2 BW, 160 - 1/2 BW and center frequency of the IF BW selected.



*INSERT WJ DISK (P/N 199711) TO CONTROL AND COMMAND THE IFC IN REMOTE MODE.

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Figure 4-5. Remote Control Test Set-up

Commands	Description
CLRn	Clear memory channel n.
CORn	Set COR Level to n.
COR?	What is the COR level setting?
CST?	What is the status of COR (CST = On, CST/ = Off)?
CW	Turn on CW Detection Mode.
DET?	What detection mode is selected?
ENLf	Enable lockout channel with frequency f (in MHz).
ENL/f	Disable lockout channel with frequency f (in MHz).
FBW	Set full bandwidth scan.
FBW/	Reset scan increment to half the bandwidth.
FBW?	Is full bandwidth scan increment set?
FM	Turn on FM Detection Mode.
FM?	What is the FM modulation?
FMO?	What is the FM offset?
FPL	Turn front panel display on. This mode is set whenever the unit returns to local mode.
FPL/	Turn front panel display off.
FPL?	Is front panel display on?
FRQf	Set tuned frequency in MHz.
FRQ?	What is the tuned frequency?

Commands	Description
HBW	Set half bandwidth scan.
HBW/	Reset scan increment to full bandwidth.
HBW?	Is half bandwidth scan increment set?
HER?	What are the hardware error bytes? (refer to paragraph 4.8.2.)
LCH?	What is the number of lockout channels used?
LCK	Lockout current tuned frequency and currently selected bandwidth.
LKFf,f	Lockout center frequency and bandwidth (in MHz).
LKRf,f	Lockout start frequency and stop frequency (in MHz).
MAN	Set to Manual Mode.
MOD?	What is the front panel mode? MAN = Manual, SCN = Scan, STP = Step, SCM = Scanpause, STM = Steppause.
OPT?	What options are installed?
PARn,m	Partition memory. Channel numbers less than the first parameter are for scan. Channel numbers greater or equal to the second parameter are for lockout. Those between are for step.
PAR?	How is memory partitioned?
PLS	Turn on Pulse Detection Mode.
PSE	Change from SCAN to SCANPAUSE or from STEP to STEPPAUSE state. If not in SCAN or STEP state, no action is taken.
QUE?	What are the frequencies in the SCAN/STEP queue?
RCEn	Recall and enter memory channel n.
RCHn	What are the parameters of channel n?
RER?	What are the remote error bytes? (See Note 1)
RFGn	Set RF Atten (00 = Minimum, 99 = Maximum).
RFG?	What is the RF Atten?
RLKn?	What are lockout parameters (frequency, BW, or start and stop frequency) of channel n?
RMT	Place unit in remote control.
RMT/	Place unit in local control.
RMT?	Is the unit in remote or local control?
SCHxxx	Set memory channel parameters. (See Note 2)
SCIf	Set scan increment.
SCI?	What is scan increment (in MHz)?
SCN	Use to continue scanning from scanpause state.
SCNn	Start scan using channel n as argument.
SS?	What is the signal strength (in - dBm)?
SSOn	What are the Scan/Step options for channel n?
SSO?	What are the scan/step options?
STMn	Set status mask for serial poll status.
STM?	What is the status mask?
STOn	Store currently active parameters in memory channel n.
STS?	What is the serial poll status byte?

Commands	Description
STP	Continue stepping from STEPPAUSE state.
STPn	Start step using channel n as argument.
VER?	What is the unit model and revision level? Response is in the form VER 8969 WXXU where W = letter revision of unit, XX = dash number of unit, U = firmware letter designation

---

Notes:

1. Remote Error Bytes:

Illegal ASCII code	1
Invalid ASCII Argument	2
Invalid Memory Remote Channel	4
Lockout Not Found	8
Not in Remote	16
Illegal BW for CW	32

2. Memory Channel Parameters(xxx):

mch	- MCHn (memory channel number)
enb	- ENB,ENB/ (enable/disable memory)
frq	- FRQf
bw	- BWn
cor	- CORn
det	- AM, FM, CW, PLS
afc	- AFC, AFC/
agc	- AGC, AGC/
rfg	- RFGn

Table 4-16. Remote Control Test Record

AFC	_____( )	HBW?	_____( )
AFC/	_____( )	HER?	_____( )
AFC?	_____( )	LCH?	_____( )
AGC	_____( )	LCK	_____( )
AGC/	_____( )	LKFf,f	_____( )
AGC?	_____( )	LKRf,f	_____( )
AM	_____( )	MAN	_____( )
AM?	_____( )	MOD?	_____( )
BWC?	_____( )	OPT?	_____( )
BWn	_____( )	PARn,m	_____( )
BW?	_____( )	PAR?	_____( )
CER	_____( )	PLS	_____( )
CHNn	_____( )	PSE	_____( )
CHN/N	_____( )	QUE	_____( )
CHNn?	_____( )	RCEn	_____( )
CLC	_____( )	RCHn	_____( )
CLLf	_____( )	RER?	_____( )
CLM	_____( )	RFGn	_____( )
CLRn	_____( )	RFG?	_____( )
CORn	_____( )	RLKn?	_____( )
COR?	_____( )	RMT	_____( )
CST?	_____( )	RMT/	_____( )
CW	_____( )	RMT?	_____( )
DET?	_____( )	SCH	_____( )
ENLf	_____( )	SCIf	_____( )
ENL/f	_____( )	SCI?	_____( )
FBW	_____( )	SCN	_____( )
FBW/	_____( )	SCNn	_____( )
FBW?	_____( )	SS?	_____( )
FM	_____( )	SSOn	_____( )
FM?	_____( )	SSO?	_____( )
FMO?	_____( )	STMn	_____( )
FPL	_____( )	STM?	_____( )
FLP/	_____( )	STOn	_____( )
FLP?	_____( )	STS?	_____( )
FRQf	_____( )	STP	_____( )
FRQ?	_____( )	STPn	_____( )
HBW	_____( )	VER?	_____( )
HBW/	_____( )		

4.7.17 AC POWER LINE CHECK

1. Verify that the AC switch on the IFC unit is set to 230 Vac.
2. Connect the IFC unit to 230 Vac, 50 Hz single-phase power.
3. Turn the unit on and verify the unit powers-up according to paragraph 4.7.3.
4. Return AC switch on the IFC unit to 115 Vac.

4.8 TUNER AND IFC COMBINED SYSTEM TESTS

Combine any tuner that has completed the tuner test and any IF Demodulator/Controller that has completed the IF Demodulator/Controller test to perform the tests as specified in this section.

4.8.1 POWER UP

When the system is initially powered-up, it runs a self test to check for any faults in the system. Error messages are displayed in the unit's alphanumeric display describing any errors that may be present. (These errors are checked in paragraph 4.8.2, BITE Test.) Also during power-on, the receiver runs a calibration program that sets IF gain.

After all error checking and calibration is complete (which takes about five seconds), the receiver should be in the following mode of operation.

FREQUENCY[1]	1000.000 MHz (with a "*" on the 10 MHz digit)
COR	On
AGC	On
AFC	Off
REM	Off
TUNE LOCK	Off
TUNE	Center
IF BW	BYP
DET MODE	AM
COR LVL	00
SIG STR	<-80
Tuning Rate	10 MHz
Key Lights	All Off
Mode	Manual

Unless otherwise specified, the front panel controls shall be set as above with the AGC off for all tests in this section.

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[1]The frequency displayed is the bottom edge frequency of the receiver.

4.8.2 BITE (Built In Test Equipment) TEST

4.8.2.1 General

The receiver BITE tests provide the following error messages. Perform the indicated operations to verify the error messages.

NOTE

The tuner and IFC units have to be opened to perform these operational tests.

Error Messages	Error Bytes
1. REFERENCE UNLOCKED	1 Word 1
2. FIRST LO UNLOCKED	2 Word 1
3. SECOND LO UNLOCKED	4 Word 1
4. A/D NOT CONVERTING	16 Word 1
5. NO RECEIVER BWs FOUND	32 Word 1
6. ILLEGAL BW CODE DETECTED	64 Word 1
7. TUNER NOT RESPONDING	128 Word 1
8. CAL ERROR-TUNER CABLE	1 Word 1

4.8.2.2 Operations

Perform the following to check that the cited error messages are functioning:

1. REFERENCE UNLOCKED - This message cannot be verified unless a module is broken into. It is a verification that can only be performed at the factory.

2. FIRST LO UNLOCKED - Perform the following to verify this message:

   a. Power off the tuner.

   b. Disconnect wire J4 between the tuner junction board (A12) and the first LO synthesizer board (A4).

   c. Power on the tuner.

   d. Verify that the message "FIRST LO UNLOCKED" appears on the IFC unit front panel display.

   e. Power off the tuner.

   f. Reconnect wire J4.

3. SECOND LO UNLOCKED - Perform the following to verify this message:

   a. Power off the tuner.

   b. Disconnect wire J3 between the tuner junction board (A12) and the second LO board (A3).

   c. Power on the tuner.

   d. Verify that the message "SECOND LO UNLOCKED" appears on the IFC unit front panel display.

   e. Power off the tuner.

   f. Reconnect wire J3.

4. A/D NOT CONVERTING, ILLEGAL BW CODE DETECTED, and NO RECEIVER BWs FOUND - Perform the following to verify this messages:

   a. Power off the IFC unit.

   b. Remove the analog interface board (A6).

   c. Power on the IFC unit.

   d. Verify that these messages appear, in succession, on the IFC unit front panel display.

   e. Power off the IFC unit.

   f. Replace the analog interface board (A6), making sure that it is properly seated.

5. TUNER NOT RESPONDING - Perform the following to verify this message:

   a. Power off the tuner.

   b. Verify that this message appears on the IFC unit front panel display.

6. CAL ERROR - TUNER CABLE - Perform the following to verify this message:

   a. Power off the tuner.

   b. Disconnect wire J6 between the tuner junction board (A12) and IF assembly (A6).

   c. Power on the tuner.

d. Verify this message appears on the IFC unit front panel display.

e. Power off the tuner.

f. Reconnect wire J6.

4.8.3 FRONT PANEL FUNCTIONAL CHECKS

4.8.3.1 Scan

1. Connect equipment as shown in Figure 4-6.

2. Using the SCAN SEGMENT MENU, input the following information into the scan channels. (Tuner TU0112 is used for this example.)

a.	Channel #	01
b.	START FREQ	1000 MHz
c.	STOP FREQ	2000 MHz
d.	IF BW	Any
e.	DET MODE	Any
f.	COR Level	Set COR Level so that if an intercept is made on a -30 dBm CW input signal, the COR indicator light will come on.
g.	AGC Option	On or Off
h.	AFC Option	On or Off

3. Repeat step 2 for scan channels 03, 05, and 07 using the following start-stop frequencies: 2000 to 4000 MHz, 4000 to 8000 MHz, and 8000 to 12400 MHz. (Note: The start and stop frequencies use up two memory channels.)

4. Input a synthesized -30 dBm CW signal into the RF input of the tuner. Tune signal generator to a frequency stored in each of the scan channels and verify the following operation available on the Scan/Step Options Menu. Use the Frequency Queue Menu to verify the intercepted frequencies. Also verify that the COR Level and Signal Strength readout correspond to the level of the input signal.

a) Multi-Sequence Scan	If NO, the receiver will scan only the enabled channel (start channel) to the next channel (stop channel). If YES, the receiver will scan all the enabled channels up to the currently selected scan channel.

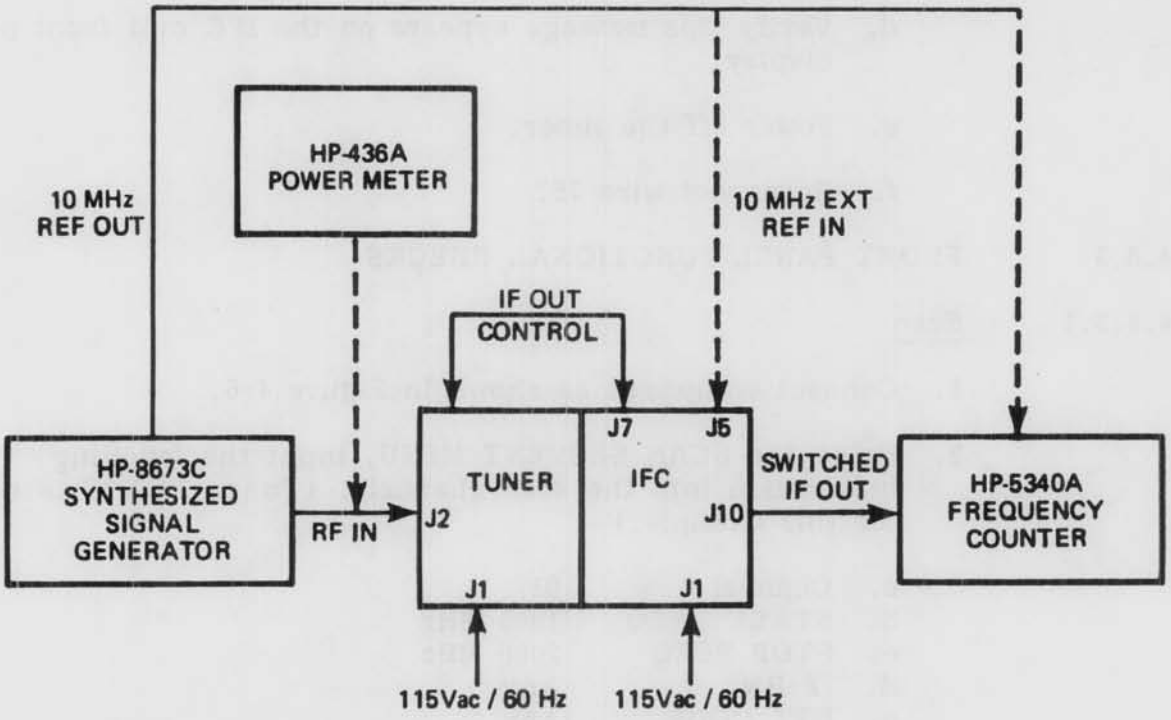


Figure 4-6. Front Panel Functional Checks, Tuning Accuracy (with/without External Reference), AFC Operation, COR Level, and Signal Strength Test Setup

b) Queue Sig-Don't Stop

If NO, the receiver will stop at an input signal that is within the scan frequency range and above the COR threshold.

If YES, the receiver will not stop at an input signal that is within the scan frequency range and above the COR threshold.

c) Hold After Sig Gone

If NO, the receiver will continue scanning after the signal that caused it to stop is removed.

If YES, the receiver will stop scanning after the signal that caused it to stop is removed.

d) Hold After One Pass

If NO, the receiver will continue scanning.

If YES, the receiver will stop after one pass.

e) Detect Leadedge Only	If NO, the receiver will ignore this command. If YES, the receiver will detect signals at the leading edge.
f) Hold If Queue Full	If NO, the receiver will continue stopping at signals when the Queue Sig-Don't Stop is set to NO. If YES, the receiver will stop when it has stopped at more than 15 signals when the Queue Sig-Don't Stop is set to NO.
g) Half BW Scan	If NO, the receiver will ignore this command. If YES, the receiver will scan at increments equal to one-half the selected BW.
h) Full BW Scan	If NO, the receiver will ignore this command. If YES, the receiver will scan at increments equal to the full BW selected.
i) Scan Increment	If Half BW Scan and Full BW Scan are set to NO, this message is displayed. Scan increments from 1 kHz to 100 MHz can be selected. If Half BW Scan or Full BW Scan is selected, the receiver will ignore this command.

4.8.3.2 Step

1. Connect equipment as shown in Figure 4-6.
2. Store the following frequencies into the step channels with the parameters given below. (Tuner TU0112 is used for this example.)

Frequency

Channel #30	1500 MHz
Channel #31	3000 MHz
Channel #32	6000 MHz
Channel #33	10000 MHz

Parameters

IF BW	Any
DET MODE	Any
COR Level	Set COR Level so that if an intercept is made on a -30 dBm input signal, the COR indicator will light.
AGC	On or Off
AFC	On or Off

3. Input a synthesized -30 dBm CW signal into the RF input of the tuner. Tune signal generator to a frequency stored in each of the step channels and verify the following operations available on the Scan/Step Options Menu. Use the Frequency Queue Menu to verify the intercepted frequencies. Also verify that the COR Level and Signal Strength readout correspond to the level of the input signal.

a. Queue Sig-Don't Stop	If NO, the receiver will stop at an input signal that is at the step frequency. If YES, the receiver will not stop at an input signal that is at the step frequency.
b) Hold After One Pass	If NO, the receiver will continue stepping. If YES, the receiver will stop after one pass.
c) Hold If Queue Full	If NO, the receiver will continue stopping at signals when the Queue Sig-Don't Stop is set to NO.

4.8.3.3 Lockout

1. Connect equipment as shown in Figure 4-6.

2. Using the LKOT key, store the following frequencies and IF BW into the lockout channels. (Tuner TU0112 is used for this example.)

Channel #60:	1000 MHz, any IF BW
Channel #61:	1500 MHz, 2000 MHz
Channel #62:	2500 MHz, any IF BW
Channel #63:	3000 MHz, 4000 MHz
Channel #64:	4500 MHz, any IF BW
Channel #65:	5000 MHz, 8000 MHz
Channel #66:	9000 MHz, any IF BW
Channel #67:	10000 MHz, 12400 MHz

NOTE

For channels 60, 62, 64, and 66, the receiver will not intercept signals at the lockout frequency ±½ the IF BW selected. For channels 61, 63, 65, and 67, the receiver will not intercept signals between the two lockout frequencies.

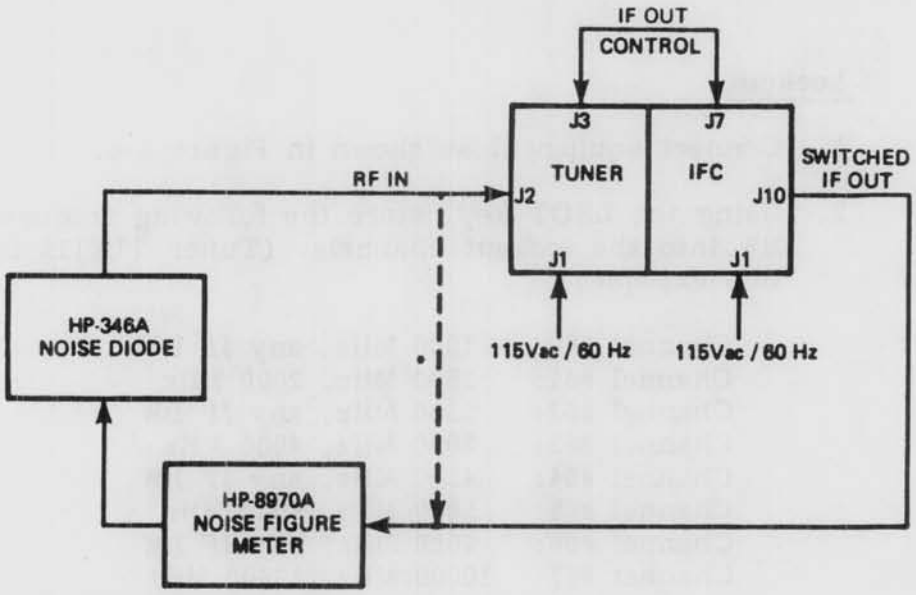
3. Input a synthesized -30 dBm CW signal into the RF input of the tuner. Set COR to just break threshold. Tune signal generator to each of the lockout frequencies entered in step 2. Set unit to SCAN from 1000 MHz to 12400 MHz and verify the receiver does not intercept the signal.

4.8.4 NOISE FIGURE, RF/IF GAIN

1. Connect equipment as shown in Figure 4-7. On the IFC unit, select the largest IF BW centered on 160 MHz.

2. Calibrate noise figure meter as follows:

Enter: 1.3
Press: SPECIAL FUNCTION
Press: START FREQ
Enter: Lower Frequency of Tuner
Press: STOP FREQ
Enter: Upper Frequency of Tuner
Enter: 3.0
Press: SPECIAL FUNCTION
Enter: 21.4 MHz or 160 MHz



*CONNECT NOISE DIODE TO THE NOISE FIGURE METER AS SHOWN WHEN CALIBRATING THE NOISE FIGURE METER.

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Figure 4-7. Noise Figure, RF/IF Gain Test Setup

Press: SMOOTHING (DECREASE or INCREASE button, until smoothing = 8)
Press: CORRECTED NOISE FIGURE AND GAIN
Connect noise diode to the noise figure meter input.
Press: CALIBRATE
The noise figure meter should now be calibrated.

3. Connect noise diode to the RF input of the tuner and tune receiver to the low band edge. Set noise figure meter to the same frequency as the receiver.

4. Read and record the noise figure and RF/IF Gain.

5. Repeat steps 3 and 4 for the remaining frequencies indicated on Table 4-17.

6. If Option AA is installed, repeat steps 1 through 5 for the largest BW centered on 21.4 MHz. See Table 4-18.

7. Tables 4-17 and 4-18 give the specifications for this test.

NOTE

If the RF/IF Gain is out of the range of the noise figure meter, use the RF ATTEN on the IFC to bring the readings within the range of the noise figure meter. Add the RF ATTEN value to the noise figure meter gain reading to obtain the RF/IF gain.

Table 4-17. Noise Figure, RF/IF Gain (160 MHz IF BW) Test Specifications

160 MHz IF BW _____

Tuner[1]	Tuned Frequency (MHz)	Noise Figure (dB)	Spec Max (dB)	RF/IF Gain (dB)	Spec Min (dB)
TU0145, TU0112	1000		15		40
	1500		15		40
	2000		15		40
	2500		15		40
	2999		15		40
	3000		15		40
	3500		15		40
TU0412	4000		15		40
TU0145	4500		15		40
	5000		15		40
	5999		15		40
	6000		15		40
	7000		15		40
	8000		15		40
	8999		15		40
	9000		15		40
	10000		15		40
	11000		15		40
	12000		15		40
TU0412, TU0112	12400		15		40

[1]Tuner band limits. Take data within these limits.

Table 4-18. Noise Figure, RF/IF Gain (21.4 MHz IF) Test Specifications

21.4 MHz IF BW _____

Tuner[1]	Tuned Frequency (MHz)	Noise Figure (dB)	Spec Max (dB)	RF/IF Gain (dB)	Spec Min (dB)
TU0145, TU0112	1000	____	15	____	40
	1500	____	15	____	40
	2000	____	15	____	40
	2500	____	15	____	40
	2900	____	15	____	40
	3000	____	15	____	40
	3500	____	15	____	40
TU0412	4000	____	15	____	40
TU0145	4500	____	15	____	40
	5000	____	15	____	40
	5999	____	15	____	40
	6000	____	15	____	40
	7000	____	15	____	40
	8000	____	15	____	40
	8999	____	15	____	40
	9000	____	15	____	40
	10000	____	15	____	40
	11000	____	15	____	40
	12000	____	15	____	40
TU0412, TU0112	12400	____	15	____	40

[1]Tuner band limits. Take data within these limits.

4.8.5 TUNING ACCURACY

1. Connect equipment as shown in Figure 4-6. Select the largest IF BW centered on 160 MHz.

2. Tune receiver to the low band edge. Input a synthesized -30 dBm CW signal tuned to the same frequency as the receiver.

3. Measure and record the error frequency. (Example: Tuned frequency = 1000 MHz, expected IF frequency = 160.0000 MHz, measured IF frequency = 160.0001 MHz, error frequency = +100 Hz.)

4. Repeat steps 2 and 3 for the remaining frequencies indicated on Table 4-19.

5. Repeat steps 1 through 4 with the external reference input disconnected at the (J5) 10 MHz External Reference In of the IFC.

6. If Option AA is installed, repeat steps 1 through 5 for the largest IF BW centered on 21.4 MHz

4.8.6 AFC (AUTOMATIC FREQUENCY CONTROL) OPERATION

1. Connect equipment as shown in Figure 4-6. On the receiver set AFC on, COR Level to 00, and select the largest IF BW centered on 160 MHz.

2. Input a synthesized -60 dBm CW signal tuned to mid-band of the receiver. Tune receiver to the input signal frequency.

3. The frequency out on the (J10) Switched IF Out should be at center frequency and the TUNE LED bar indicator on the IFC should be at center.

4. Vary the input signal frequency up and down from its initial setting and note that the receiver tracks the input frequency. Also note that the TUNE LED bar indicators indicate HI when the input signal is tuned down and LO when the input signal is tuned up.

Table 4-19. Tuning Accuracy Specifications

Tuner[1]	Tuned Frequency (MHz)	With External Reference Error Frequency (Hz)	Spec Max (Hz)	Without External Reference Error Frequency (Hz)	Spec Max (Hz)
TU0145, TU0112	1000	_____	±1	_____	±100
	1500	_____	±1	_____	±150
	2000	_____	±1	_____	±200
	2500	_____	±1	_____	±250
	2999	_____	±1	_____	±300
	3000	_____	±1	_____	±300
	3500	_____	±1	_____	±350
TU0412	4000	_____	±1	_____	±400
TU0145	4500	_____	±1	_____	±450
	5000	_____	±1	_____	±500
	5999	_____	±1	_____	±600
	6000	_____	±1	_____	±600
	7000	_____	±1	_____	±700
	8000	_____	±1	_____	±800
	8999	_____	±1	_____	±900
	9000	_____	±1	_____	±900
	10000	_____	±1	_____	±1000
	11000	_____	±1	_____	±1100
	12000	_____	±1	_____	±1200
TU0412, TU0112	12400	_____	±1	_____	±1240

[1]Tuner band limits. Take data within these limits.

5. To measure the AFC range, set input signal frequency to a frequency that is 3/4 of the IF BW selected below the initial setting. Slowly tune the signal generator toward the initial setting and note where the front panel frequency display starts to track the input signal.

   Record the lower range of the AFC as: Input Frequency - Initial Frequency on Table 4-20. Repeat test for the upper range of the AFC by setting the signal generator to 3/4 the IF BW selected above the initial setting.

6. If Option AA is installed, repeat steps 2 through 5 for the largest IF BW centered on 21.4 MHz.

4.8.7 COR (CARRIER OPERATED RELAY) LEVEL

1. Connect equipment as shown in Figure 4-6. Tune receiver to the high band edge. Select BYP IF BW AGC on and set COR LEVEL to 01.

2. Tune synthesized CW signal generator to the same frequency as the receiver and set its output to just when the COR indicator on the front panel display is lighted. Record this input power level on Table 4-21.

3. Set COR LEVEL to the next value listed in Table 4-21. The COR indicator light should turn off. Increase signal generator power until the COR indicator lights again. Record this input power level on Table 4-21. Calculate and record the COR LEVEL change by subtracting the input power level obtained in step 2 from the input power level obtained in this step.

Table 4-20. AFC (Automatic Frequency Control) Operation Data Record

AFC Range	160 MHz IF BW ____ Input[1] Frequency (MHz)	21.4 MHz IF BW ____ Input[1] Frequency (MHz)
Upper		
Lower		

[1]For information only.

Table 4-21. COR (Carrier Operated Relay) Level Test Specifications

COR Level	Input Power (dBm)	Measured Level	Spec
01	_____	X	X
10	_____	_____	9 ± 3
20	_____	_____	19 ± 3
30	_____	_____	29 ± 3
40	_____	_____	39 ± 3
50	_____	_____	49 ± 3
60	_____	_____	59 ± 3

COR indicator light always on at 00 _____ ( )
COR indicator light always off at __ _____ ( )

4. Repeat step 3 for the remaining COR LEVEL settings indicated on Table 4-21.

5. Verify the COR indicator light is always on at 00 setting and off at ___ setting. Record on Table 4-21.

4.8.8 SIGNAL STRENGTH

1. Connect equipment as shown in Figure 4-6. Select the largest IF BW centered on 160 MHz, set AGC on, and press RF Attenuation.

2. Tune both the synthesized CW signal generator and the receiver to a frequency where the RF/IF gain is average. Refer to paragraph 4.8.4 and select the RF/IF gain that is approximately the mid point between the highest and lowest RF/IF gain reading. Set signal generator to where the RF attenuation goes above 00. Record the input power and the signal strength readout on Table 4-22.

3. Increase the input power level by 10 dB. Record the input power level and the signal strength readout on Table 4-22.

4. Repeat step 3 for a total power increase of 80 dB in 10 dB steps.

5. If Option AA is installed repeat steps 1 through 4 for the largest IF BW centered on 21.4 MHz.

Table 4-22. Signal Strength Data Record

Power Increase (dB)	Input Power (dBm)	160 MHz IF BW _____ Signal Strength[1] Readout (dBm)	21.4 MHz IF BW _____ Signal Strength[1] Readout (dBm)
0	_____	_____	_____
10	_____	_____	_____
20	_____	_____	_____
30	_____	_____	_____
40	_____	_____	_____
50	_____	_____	_____
60	_____	_____	_____
70	_____	_____	_____
80	_____	_____	_____

[1]For information only.

4.8.9 LOG VIDEO OUTPUT

This test is conducted only if Option AB is installed.

1. Connect equipment as shown in Figure 4-8. On the receiver select Pulse Detection Mode and largest IF BW centered on 160 MHz. Tune receiver to mid band frequency.

2. Set synthesized signal generator to the same frequency as the receiver and set its output to -50 dBm CW.

3. Vary the input signal level to obtain the Log Video output voltage indicated on Table 4-23. Record the input levels on Table 4-23.

4. Set synthesized generator to pulse mode with a -50 dBm output. Modulate the signal with a 10 usec PRI and a 500 nsec PW (with a rise and fall time of less than 4.5 nsec). Adjust pulse generator delay until the pulse is centered on the scope.

5. Measure and record the 90% rise and fall time points on Table 4-23.

6. If Option AA is installed, repeat steps 1 through 5 for the largest IF BW centered on 21.4 MHz.

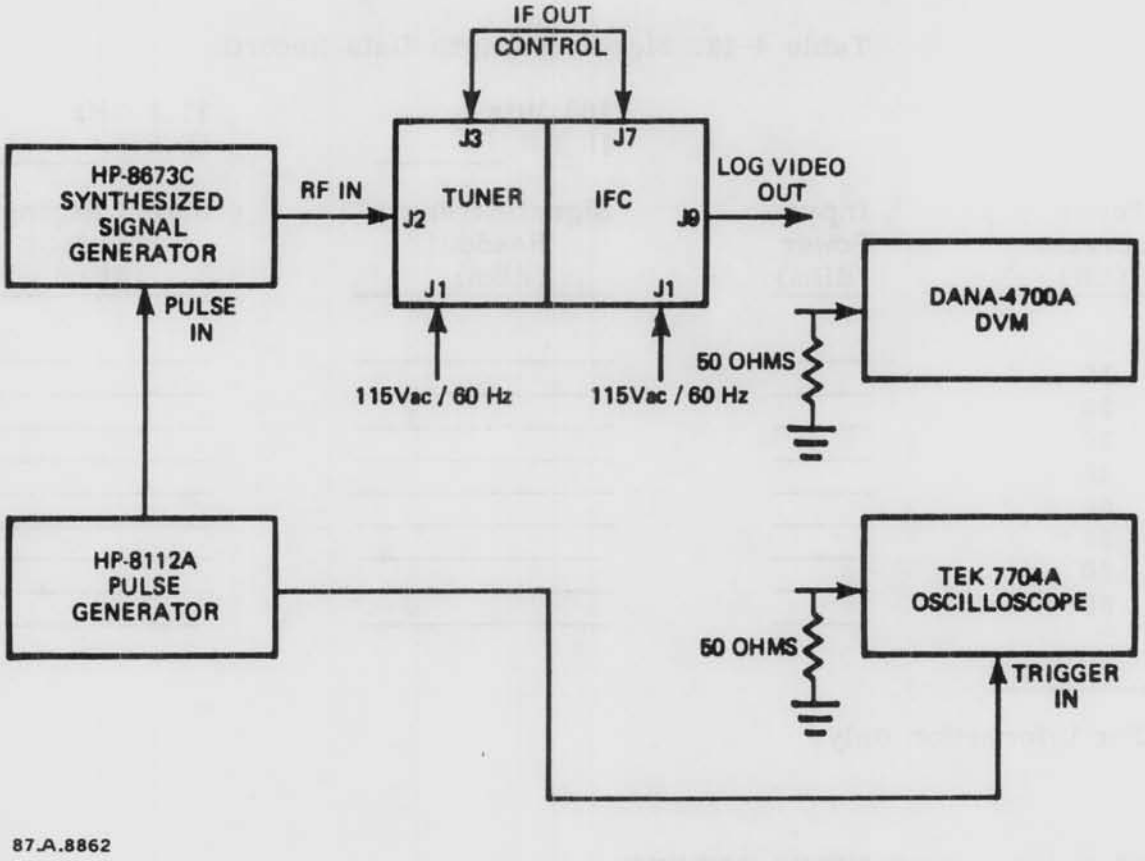


Figure 4-8. Log Video Output Test Set-up

4.8.10 FM VIDEO BANDWIDTH RESPONSE

1. Connect equipment as shown in Figure 4-9. On the receiver select FM Detection Mode, AGC on, and BYP IF BW. Tune receiver to low band edge.

2. Set synthesized signal generator to same frequency as the receiver and set its output to -20 dBm CW. On the RS-25, set Low Pass Filter to 25000 kHz, all Band Stop Filters out, and power to -15 dBm.

3. Set spectrum analyzer Start Freq to 0 Hz, Stop Freq to 3/4 the frequency of the IF BW selected, 1 dB/div, and video averaging.

4. With the spectrum analyzer measure and record the -3 dB video bandwidth at the (J13) Selected Video Out and the (J11) FM Video Out. Record on Table 4-24.

NOTE

Measure the -3 dB point from a reference level starting around 100 Hz.

Table 4-23. Log Video Output Test Specifications

Linearity	160 MHz IF BW _____	21.4 MHz IF BW _____
Log Video Output (V)	Input[1] Power (dBm)	Input[1] Power (dBm)
2.02	_____	_____
1.76	_____	_____
1.50	_____	_____
1.24	_____	_____
0.98	_____	_____
0.72	_____	_____
0.46	_____	_____
0.20	_____	_____

Pulse Fidelity	160 MHz IF BW _____	21.4 MHz IF BW _____	
Rise Time	_____ nsec	_____ nsec	Spec: 300 nsec max
Fall Time	_____ nsec	_____ nsec	Spec: 400 nsec max

[1]For information only.

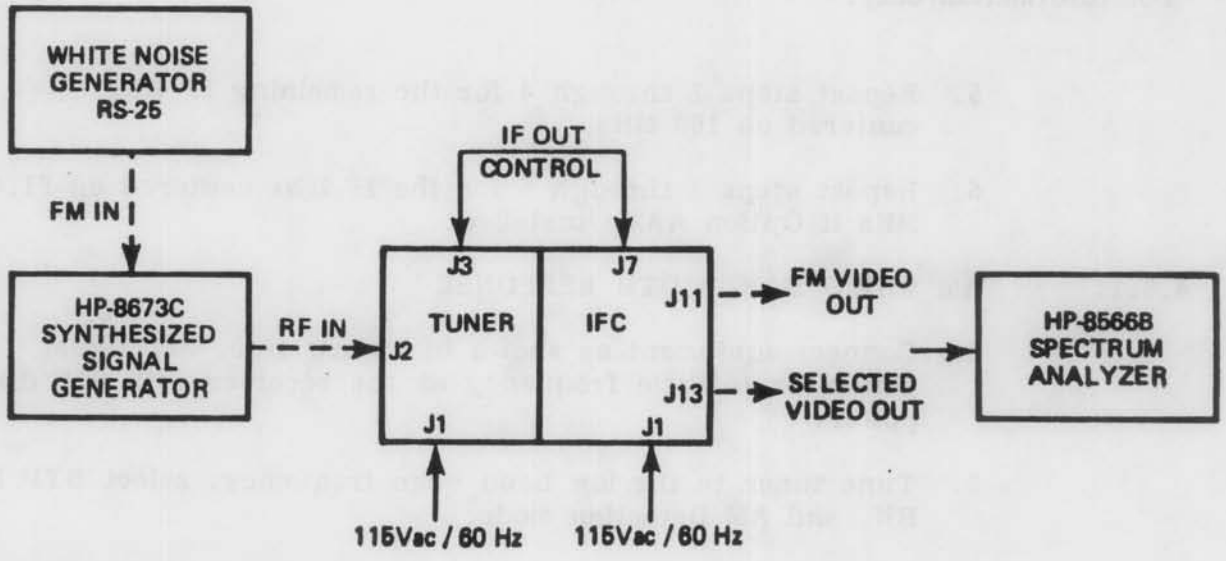


Figure 4-9. FM Video Bandwidth Response Test Set-up

Table 4-24. FM Video Bandwidth Response Data Record

160 MHz Center Frequency

IF BW[1] (MHz)	Selected[2] Video Out -3 dB Bandwidth (MHz)	FM Video Out[2] -3 dB Bandwidth (MHz)
BYP		

21.4 MHz Center Frequency

IF BW[1] (MHz)	Selected[2] Video Out -3 dB Bandwidth (MHz)	FM Video Out[2] -3 dB Bandwidth (MHz)

[1]Record the IF BWs installed in the receiver.

[2]For information only.

5. Repeat steps 1 through 4 for the remaining IF BWs centered on 160 MHz.

6. Repeat steps 1 through 5 for the IF BWs centered on 21.4 MHz if Option AA is installed.

4.8.11 AM VIDEO BANDWIDTH RESPONSE

1. Connect equipment as shown in Figure 4-10. Set signal generator to same frequency as the receiver with +10 dBm power.

2. Tune tuner to the low band edge frequency, select BYP IF BW, and AM Detection mode.

3. Set spectrum analyzer to Start Frequency of 0 Hz, stop frequency of 25 MHz and 1 dB/div.

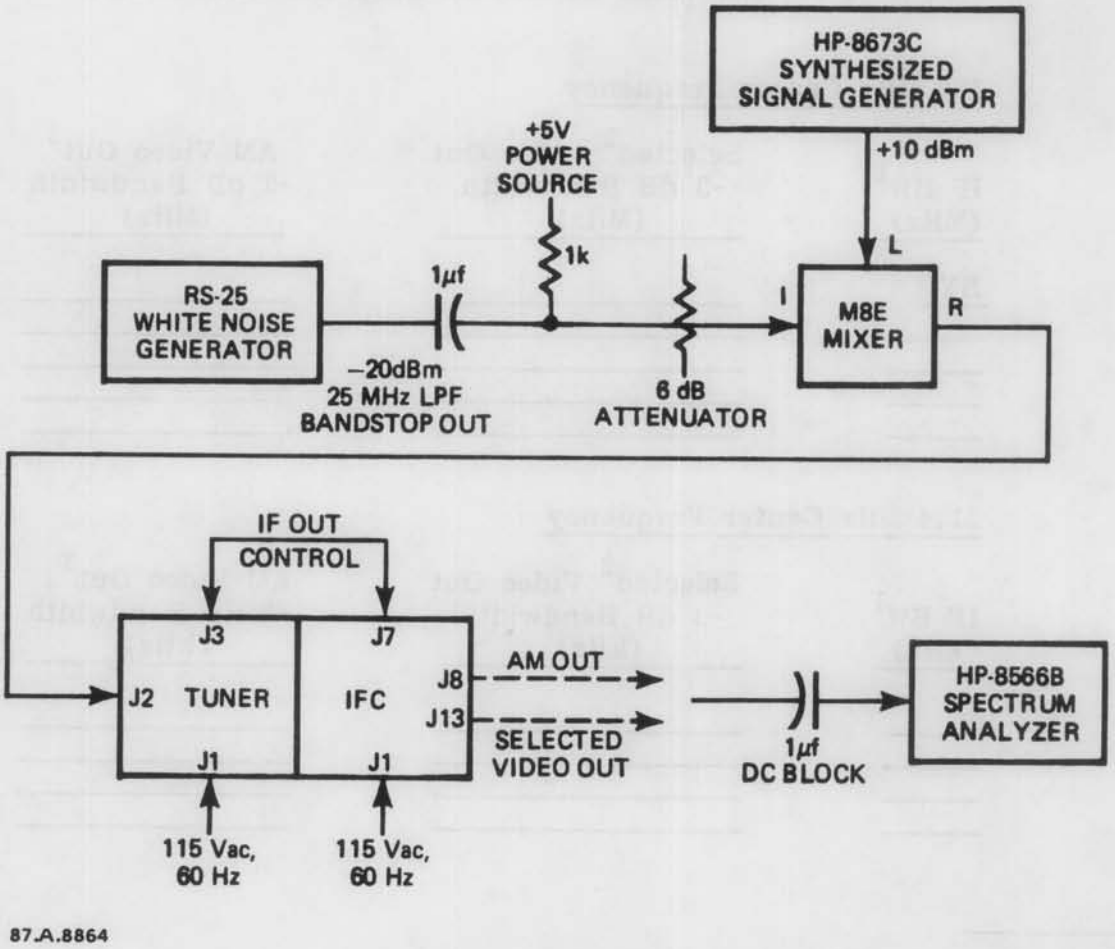


Figure 4-10. AM Video Bandwidth Response Test Set-up

4. Measure the -3 dB VIDEO BW at both the AM VIDEO OUT (J8) and the SELECTED VIDEO (J13). Record on Table 4-25.

5. Repeat steps 2 through 4 for all the remaining IF BWs centered on 160 MHz with the Stop Frequency set at 3/4 of the IF BW selected.

6. If Option AA is installed, repeat steps 1 through 5 for the IF BWs centered on 21.4 MHz.

Table 4-25. AM Video Bandwidth Response Data Record

160 MHz Center Frequency

IF BW[1] (MHz)	Selected[2] Video Out -3 dB Bandwidth (MHz)	AM Video Out[2] -3 dB Bandwidth (MHz)
BYP		

21.4 MHz Center Frequency

IF BW[1] (kHz)	Selected[2] Video Out -3 dB Bandwidth (kHz)	AM Video Out[2] -3 dB Bandwidth (kHz)

[1]Record the IF BWs installed in the receiver.

[2]For information only.

4.8.12 NOISE POWER RATIO (NPR)

1. Connect equipment as shown in Figure 4-11. Tune receiver to low band edge, select FM Detection Mode and BYP IF BW. Tune synthesized signal generator to same frequency as the receiver, set power to -30 dBm, FM modulated at 10 MHz rate. Record test results on Table 4-26.

2. To obtain NPR readings for 600 channels perform the following.

   a. Set RS-25 settings to -8.2 dBm output power, 70, 534, 1730, and 2438 kHz Band Stop Filters in, 60 to 2600 kHz Band Limiting Filter in.

   b. Set RE-25 setting to read "dB NPR," select 70 kHz Converter.

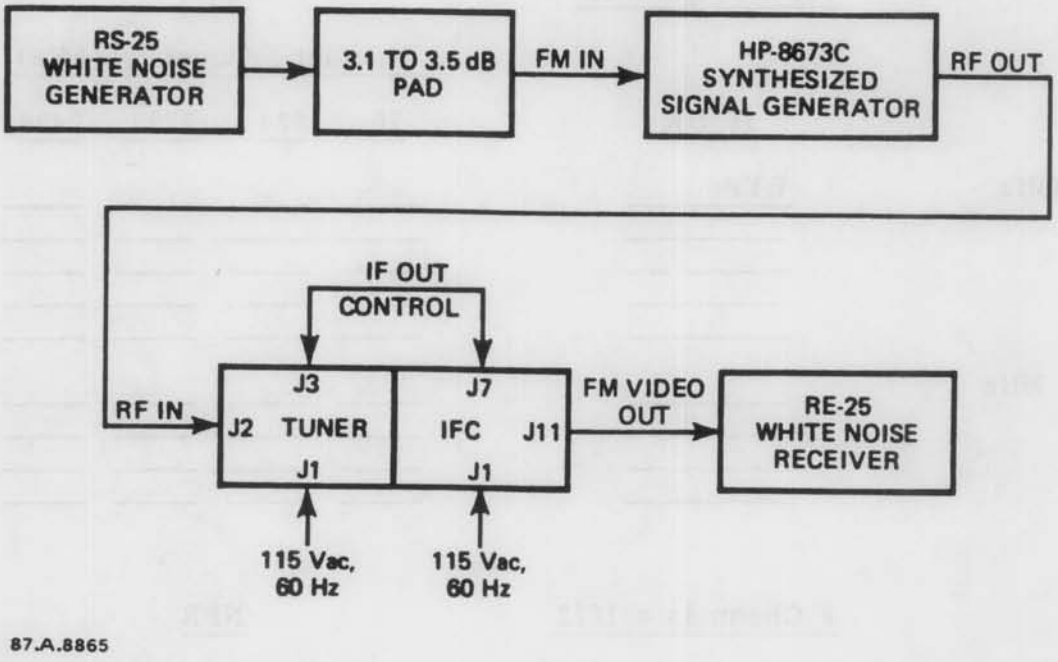


Figure 4-11. Noise Power Ratio Test Set-up

c. Calibrate by setting the STOP FILTER out on the RS-25 and pressing the AUTOMATIC PRESETTING button on the RE-25.

d. Set STOP FILTER to in on the RS-25 and record the NPR for 70 kHz channel as displayed on the RE-25.

e. Select 534 kHz Converter on the RE-25 and record NPR for 534 kHz channel frequency. Repeat for 1730 kHz and 2438 kHz channel frequencies.

3. To obtain NPR readings for 1872 channels perform the following.

a. Set RS-25 settings to -6.3 dBm output power, 70, 534, 1730, 2438, and 7600 kHz Band Stop Filters in, 12 to 8160 kHz Band Limiting Filter in.

b. Set RE-25 setting to read "dB NPR," select 70 kHz Converter.

Table 4-26. Noise Power Ratio (NPR) Data Record

# Channels = 600		NPR			
		Channel Frequency (kHz)			
	IF BW	70	534	1730	2438
160 MHz	BYP				
21.4 MHz					

# Channels = 1872		NPR				
		Channel Frequency (kHz)				
	IF BW	70	534	1730	2438	7600
160 MHz	BYP					
21.4 MHz						

c. Calibrate by setting the STOP FILTER out on the RS-25 and pressing the AUTOMATIC PRESETTING button on the RE-25.

d. Set STOP FILTER to in on the RS-25 and record the NPR for 70 kHz channel as displayed on the RE-25.

e. Select 534 kHz Converter on the RE-25 and record NPR for 534 kHz channel frequency. Repeat for 1730, 2438, and 7600 kHz channel frequencies.

4. Repeat steps 1 through 3 for the remaining IF BWs centered on 160 MHz.

5. If Option AA is installed, repeat steps 1 through 4 for the IF BWs centered on 21.4 MHz.

CHAPTER V

ASSEMBLIES AND PARTS LISTS

5.1 SCOPE OF SECTION

This section comprises an Illustrated Parts Breakdown (IPB) for the WJ-8969/IFC Tuner assemblies and modules. Table 5-1 is a list of manufacturers corresponding to the manufacturers' code numbers on the parts list.

5.2 USE OF IPB

The items in the lists, located in figures 5-1 through 5-31, are arranged by item number. The lists provide reference designations, abbreviated descriptions, manufacturers' codes, and part numbers. The meaning and use of Watkins-Johnson Company part numbers and the manufacturers' codes are described in the following paragraphs.

5.2.1 WATKINS-JOHNSON COMPANY PART NUMBERING SYSTEM

Parts designed or manufactured by Watkins-Johnson Company are identified by nine-digit part numbers. The first six digits of the part number represent the basic part design, and the last three digits, in the form of a dash number, represent the specific configuration of the basic part design.

5.2.2 MANUFACTURERS' CODES

Table 5-1 lists all of the manufacturers' codes used in the IPB. These five-digit numbers have been derived from Cataloging Handbook H4-2, Federal Supply Codes for Manufacturers, Code to Name. Codes are not used in the IPB for standard commercial or military parts.

5.3 PARTS ORDERING INFORMATION

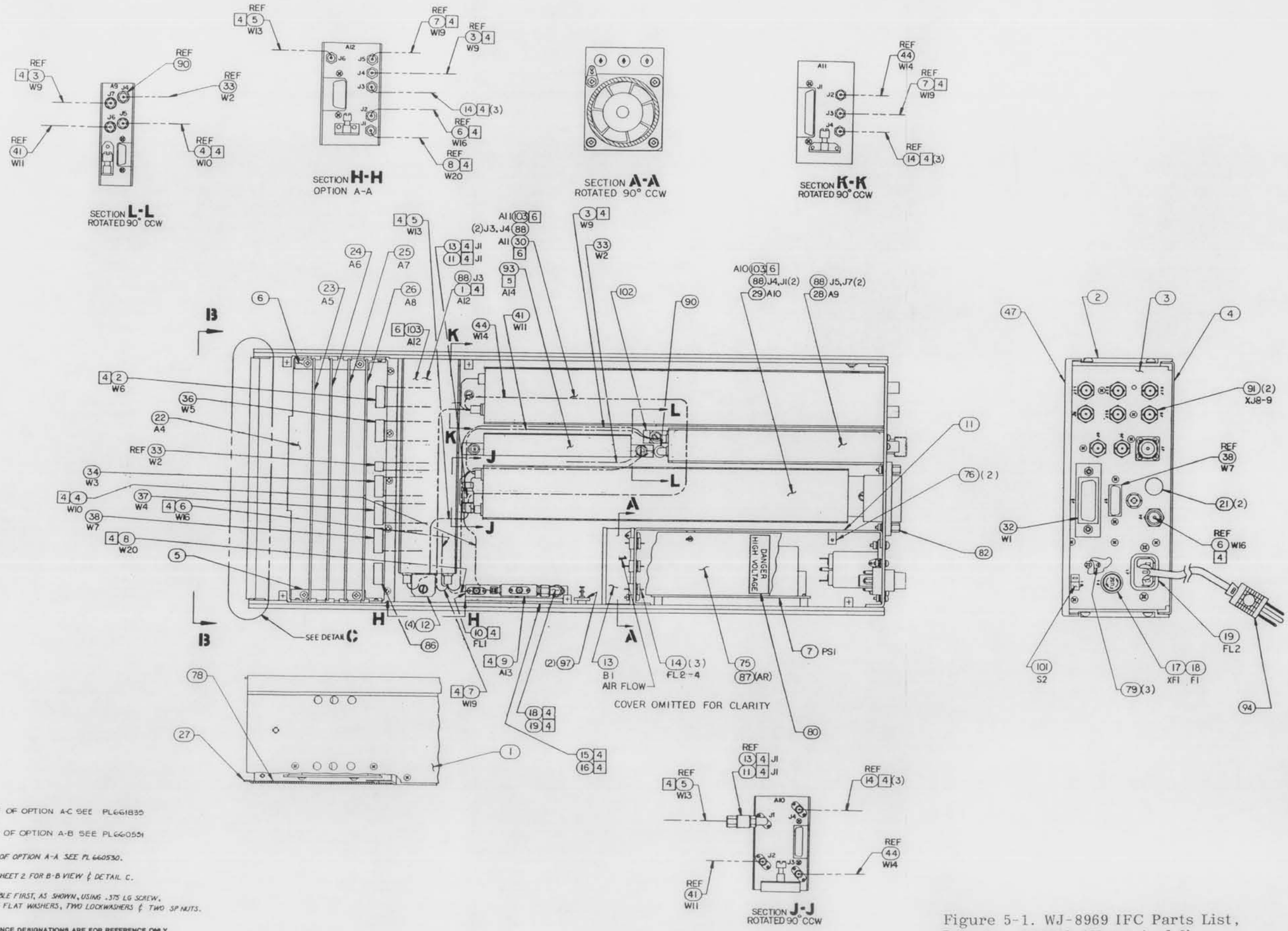
Replacement assemblies and modules may be obtained from Watkins-Johnson Company; however, replacements for standard commercial and military parts may be obtained more quickly and easily from local suppliers. When selecting a replacement part, be sure to determine the value, tolerance, rating, and description of the part from the applicable parts list.

When ordering replacement assemblies and modules from Watkins-Johnson Company, be sure to specify all pertinent information. Include information that identifies the specific system in which the module is used, as well as the name, part number, and serial number (if indicated) of

the next higher assembly for the module. Be sure to identify any modifications to the system that have been made since the system was shipped from the factory.

Replacement assemblies and modules may be ordered by mail, telephone, teletype, or cablegram. Send orders to the following address:

Mail:	Watkins-Johnson Company 2525 North First Street San Jose, California 95131-1097
Telephone:	(408) 262-1411
TWX:	910-338-0505
Cable:	WJ SNJ



6 PART OF OPTION A-C SEE PL661835

5 PART OF OPTION A-B SEE PL660551

4 PART OF OPTION A-A SEE PL 660530.

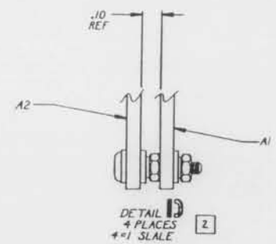
3. SEE SHEET 2 FOR B-B VIEW & DETAIL C.

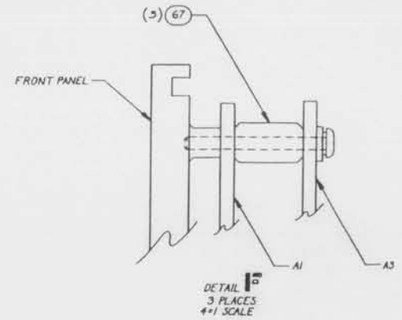
2 ASSEMBLE FIRST, AS SHOWN, USING .375 LG SCREW, THREE FLAT WASHERS, TWO LOCKWASHERS & TWO SP NUTS.

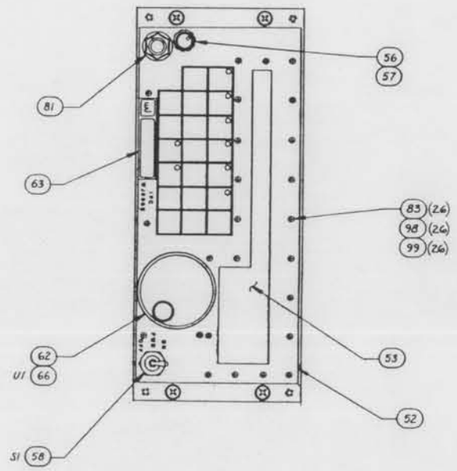
1. REFERENCE DESIGNATIONS ARE FOR REFERENCE ONLY AND MAY OR MAY NOT APPEAR ON PART

659450B/1

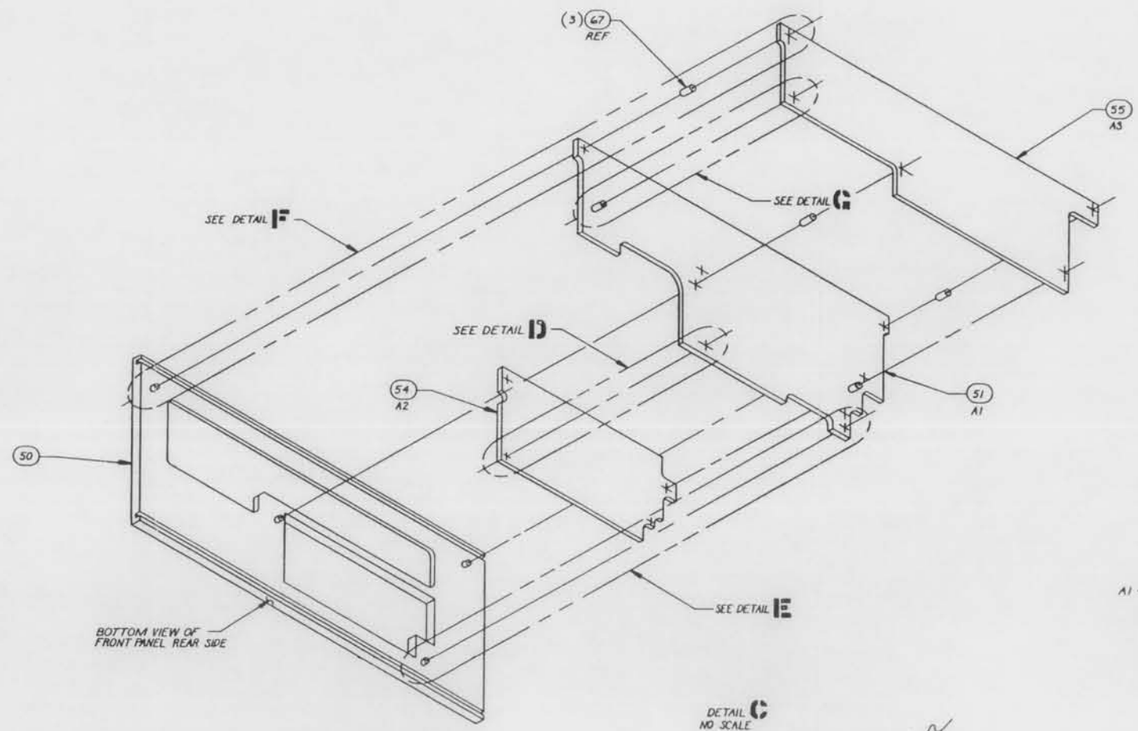
Figure 5-1. WJ-8969 IFC Parts List, Part No. 659450 (Sheet 1 of 6)

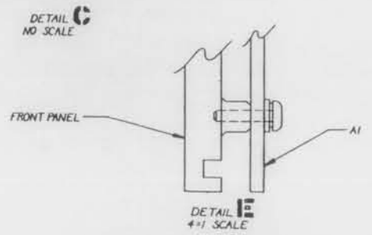






VIEW
B-B





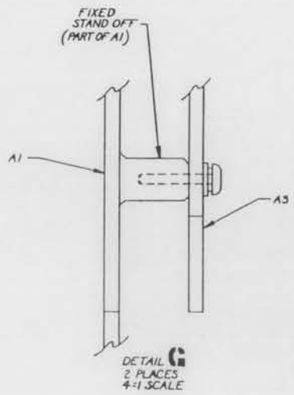


Figure 5-1. WJ-8969 IFC Parts List, Part No. 659450 (Sheet 2 of 6)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
						REV. A
001	480888-1 659458-001	14482	PLATE SIDE #1	EA	1	
002	480889-1 659460-001	14482	PLATE SIDE #2	EA	1	
003	381077-1 659461-001	14482	PANEL REAR	EA	1	
004	480887-1 659462-001	14482	COVER BOTTOM #1	EA	1	
005	180529-1 659463-001	14482	BRKT	EA	1	
006	180529-2 659463-002	14482	BRKT	EA	1	
007	660427-001 660427-001	14482	PWR SPLY MOD	EA	1	PS01
011	480898-1 659464-001	14482	PARTITION	EA	1	
012	281138-1 659607-001	14482	MTG BLOCK	EA	4	
013	812 990018-603	23936	FAN	EA	1	B01
014	51-359-001 990018-853	33095	CAP FEED THRU	EA	3	FL02 03 04
017	340255 090888-000	75915	FUSEHOLDER PNL W/CAP AND	EA	1	XF01
018	313.750 703140-075	75915	FUSE SLO-BLO 3/4AMP	EA	1	F01
019	3EF1 990018-604	05245	FLTR PWR LINE	EA	1	F02
022	796580-1 659496-001	14482	ASSY-CCA MOTHER BD	EA	1	A04
023	659589-001 659589-001	14482	ASSY-MICROPROCESSOR	EA	1	A05
024	796530-1 659501-001	14482	ASSY-CCA ANALOG INTFC	EA	1	A06
025	796531-1 659505-001	14482	ASSY-CCA DGTL INTFC	EA	1	A07
026	659509-001 659509-001	14482	ASSY-CCA IEEE488/INTERRUP	EA	1	A08

Figure 5-1. WJ-8969 IFC Parts List, Part No. 659450 (Sheet 3 of 6)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
027	381076-1 659466-001	14482	COVER BOTTOM #2	EA	1	
028	796547-1 659513-001	14482	ASSY-10MHZ REF GEN/MUX	EA	1	A09
029	796573-1 659548-001	14482	ASSY-160MHZ FLTR/IF GAIN	EA	1	A10
030	659552-001 659552-001	14482	ASSY-DEMOD	EA	1	A11
032	381104-1 659467-001	14482	ASSY-CABLE	EA	1	W01
033	17300-355-1 659468-001	14482	ASSY-CABLE	EA	1	W02
034	660194-002 660194-002	14482	ASSY-CABLE	EA	1	W03
036	381107-1 659470-001	14482	ASSY-CABLE	EA	1	W05
037	381108-1 659471-001	14482	ASSY-CABLE	EA	1	W04
038	381108-2 659471-002	14482	ASSY-CABLE	EA	1	W07
041	17300-355-4 659468-004	14482	ASSY-CABLE	EA	1	W11
044	17300-355-7 659468-007	14482	ASSY-CABLE	EA	1	W14
047	480910-1 659472-001	14482	COVER	EA	1	
050	480615-1 659453-001	14482	PANEL FRONT	EA	1	
051	796412-1 659480-001	14482	ASSY-CCA FRONT PNL DSPLY	EA	1	A01
052	380718-1 659456-001	14482	PANEL BEZEL	EA	1	
053	281276-1 659454-001	14482	WINDOW DSPLY SHLD OPTICAL	EA	1	
054	796565-1 659484-001	14482	ASSY-CCA KEYBD FRONT PNL	EA	1	A02
055	796564-1 659490-001	14482	ASSY-CCA FRONT PNL INTFC	EA	1	A03

Figure 5-1. WJ-8969 IFC Parts List, Part No. 659450 (Sheet 4 of 6)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
056	6A2N048F103AA 990017-978	01121	RES VAR 10K 10%	EA	1	
057	PS50D-1-B 585430-001	21604	KNOB RND W/IND BLACK 1/2	EA	1	
058	7101KZQ 990013-986	09353	SW TGL	EA	1	S01
062	KN-1751-BAS-1/4 585520-003	95146	KNOB SPNR 1.750D X .62LG	EA	1	
063	637697-001 637697-001	14482	NAMEPLATE SM	EA	1	
066	SP-16W/HARDWARE 990018-646		ENCODER ASSY 16 CYCLES	EA	1	U01
067	2341 543540-375	83330	SPCR RD BRS NO 4X.375	EA	3	
071	659452 659452	14482	SCHEM DIAG	EA	REF	
072	659451 659451	14482	OUTLINE DWG	EA	REF	
075	660438-001 660438-001	14482	INSULATOR PWR SPLY	EA	1	
076	660437-001 660437-001	14482	NUT PLATE	EA	2	
078	660439-001 660439-001	14482	INSUL CONTROL MOTHER BD	EA	1	
079	MS77068-1 511030-201		LUG TERM SCR LKG NO4 MIL-C-15659	EA	3	
080	SDHV-1 599000-140		LABEL WARNING*HCL CO.MENL	EA	1	
081	274-280 990019-375	83815	JACK PHONE 3 COND OPEN	EA	1	
082	553636-2 599000-160	00779	SCR LOCK HARDWARE KIT	EA	1	
083	MS51957-1B 563020-125		SCR PAN HD 2-56X1/8 BLACK FF-S-92	EA	26	
086	660179-013 660179-013	14482	ASSY-CABLE	EA	1	A4J1

Figure 5-1. WJ-8969 IFC Parts List, Part No. 659450 (Sheet 5 of 6)

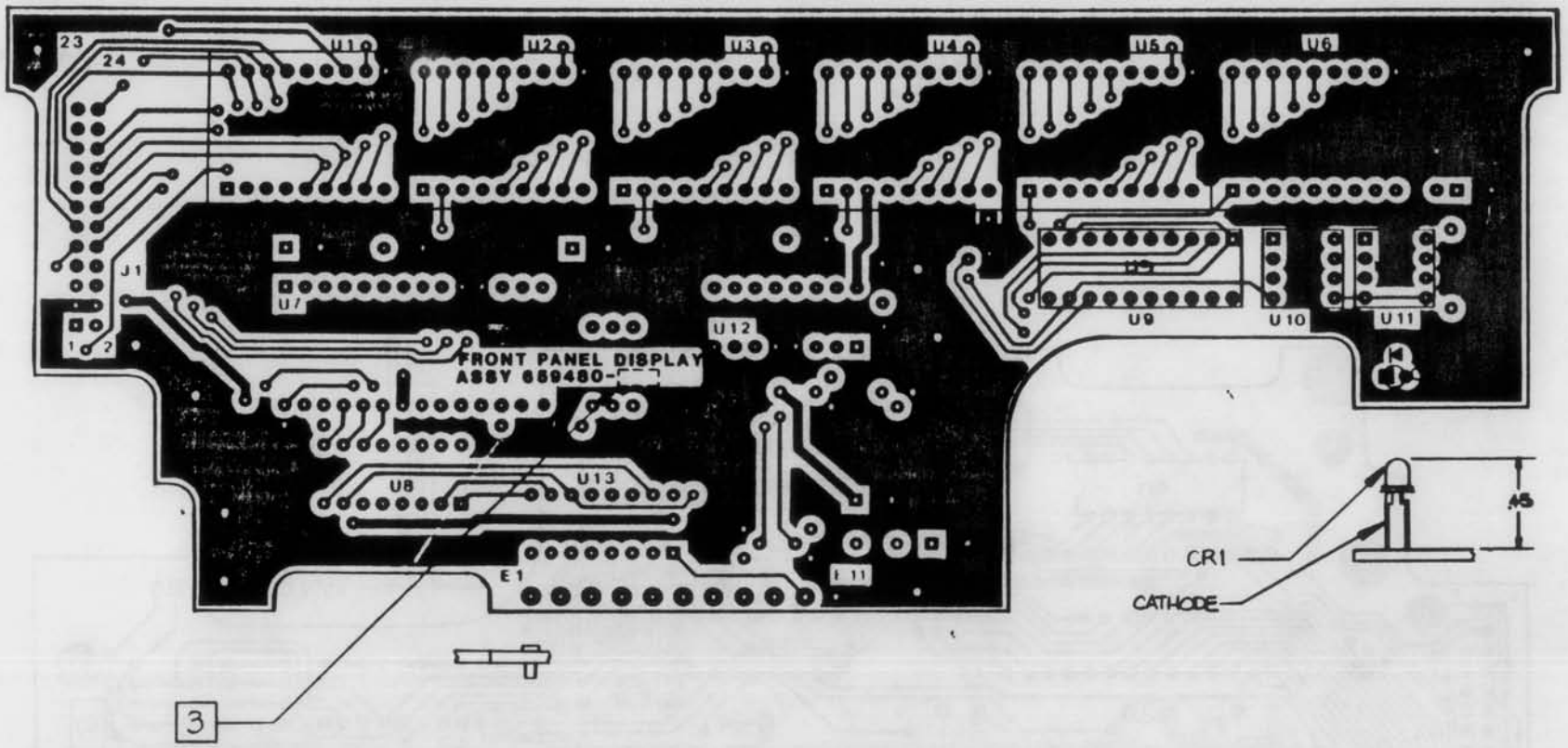
ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS	
087	50241 405000-180	91345	ADHESIVE	EA	AR		
088	OSM20020P 090999-119	16179	TERMINATION COAX SMA PLUG	EA	7	J01 03 04 05 07	
090	632675-021 632675-021	14482	ATTEN PAD 1DB DC-18GHZ	EA	1		SEE NOTE 1
091	KC-89-64 990009-700	19212	TERMN BNC MALE 50-OHM	EA	4	XJ8 XJ9	
092	660530-001 660530-001	14482	OPT AA-21.4MHZ BW	EA	REF		
093	660531-001 660531-001	14482	OPT AB LOG VIDEO	EA	REF		
094	P-2392 990018-820	82389	AC LINE CORD	EA	1		SEE NOTE 2
097	2340 543540-250	83330	SPCR RD BRS NO 4X.25	EA	2		
098	NAS620C2B 580610-002		WASHER FLAT BLACK NO. 2	EA	26		
099	MS35338-134B 580630-002		WASHER LCK-SPR NO 2 FF-W-84	EA	26		
100	661259-001 661259-001	14482	ASSY-CCA EXTENDER	EA	1		
101	661379-001 661379-001	14482	ASSY-HARNESS	EA	1		
102	659607-002 659607-002	14482	MTG BLOCK	EA	1		
103	661835-001 661835-001		OPT AC-70MHZ CONV	EA	REF		
104	WL659450 WL659450	14482	WIRE LIST	EA	REF		
			EXPLOSION FINISHED				

NOTES: UNLESS OTHERWISE SPECIFIED

1: FACTORY SELECT. NOMINAL VALUE SHOWN.

2: STANDARD CORD SHOWN: CHECK QA SUMMARY FOR SELECTED POWER CORD.

Figure 5-1. WJ-8969 IFC Parts List, Part No. 659450 (Sheet 6 of 6)



3 MARK DASH NUMBER PER MIL-STD-130 APPROXIMATELY WHERE SHOWN USING .12 HIGH CHARACTERS WITH BLACK INK COLOR NO 17038 PER FED-STD-595

2. OBSERVE POLARITY OF CAPACITORS AND SEMICONDUCTOR DEVICES

1. SOLDER PER MIL-STD-454

NOTES: UNLESS OTHERWISE SPECIFIED

659480A/1

Figure 5-2. Front Panel Display CCA A1 Parts List, Part No. 659480 (Sheet 1 of 3)

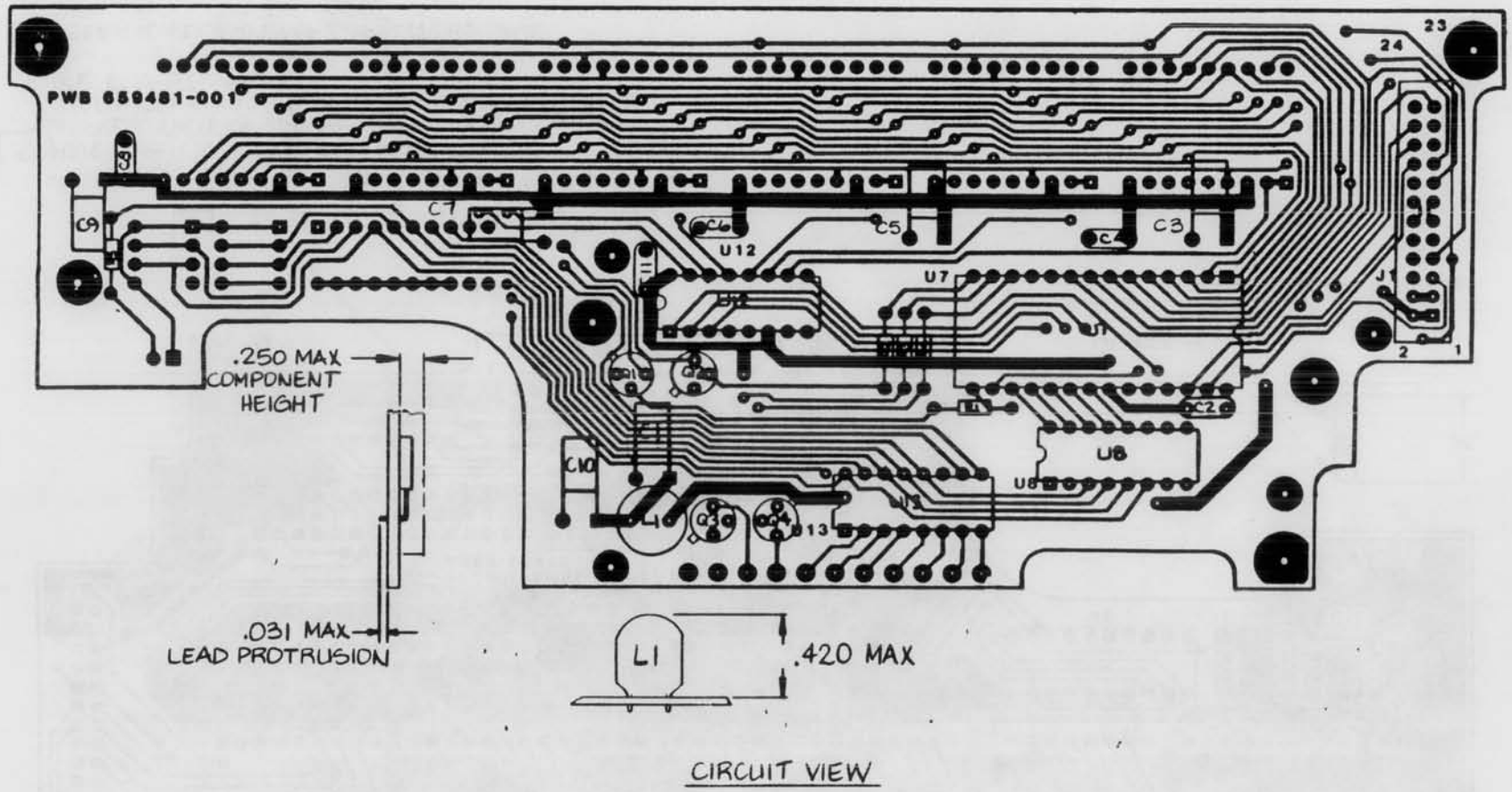
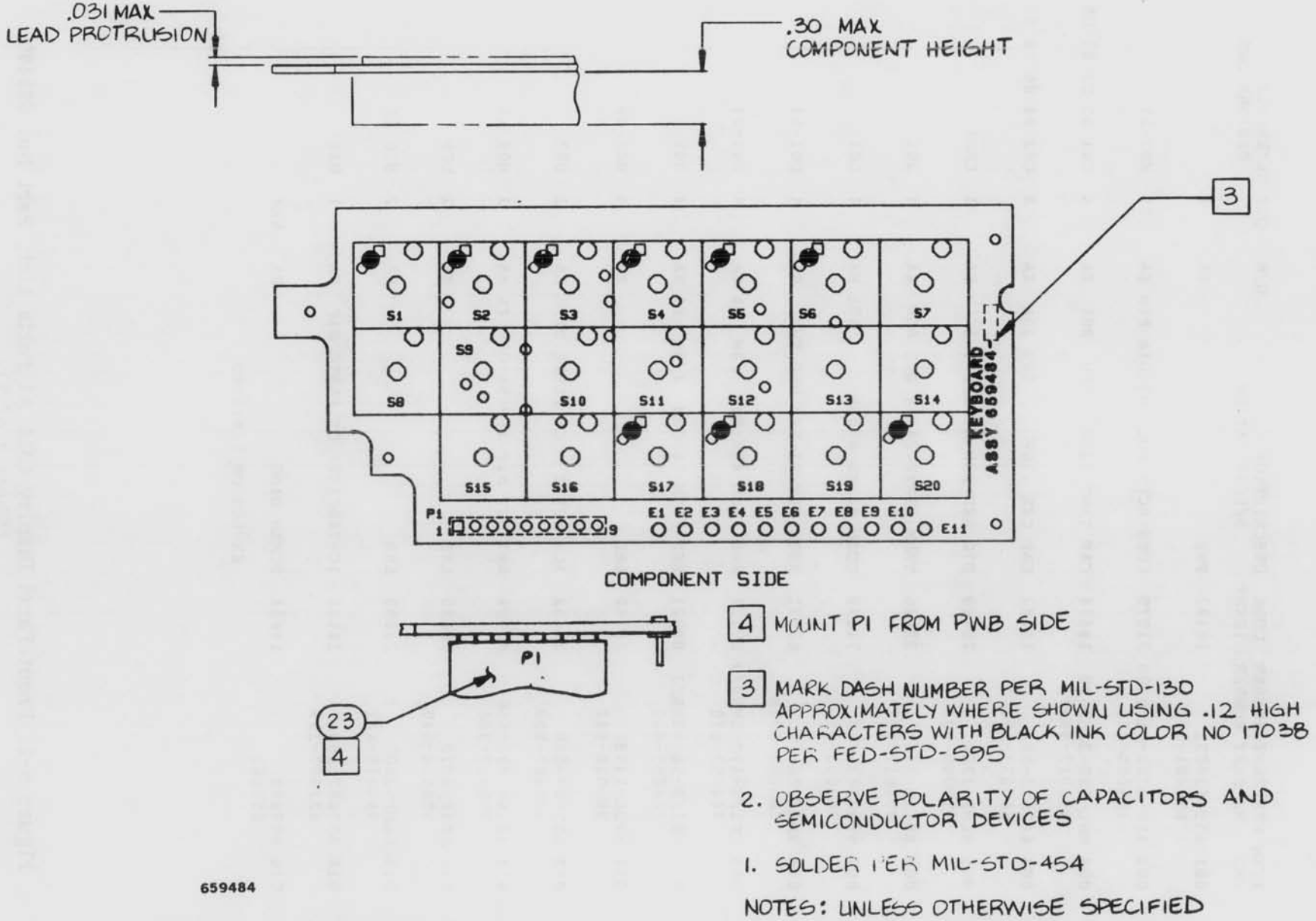


Figure 5-2. Front Panel Display CCA A1 Parts List, Part No. 659480 (Sheet 2 of 3)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
001	659481-001 659481-001	14482	PWB	EA	1	
002	450-3703-01-0300 799000-045	71279	CONN RCPT SOC .025DIA PIN	EA	11	E01-11
003	MML-010-226R-20 990017-942	14674	CAP TANT 22UF 10V 20%	EA	6	C01 03 05 07 09 10
004	660073-104 660073-104	14482	CAP CER .1UF 50V 20%	EA	5	C02 04 06 08 11
005	HLMP-1301 779000-006	28480	DIO LED RED HI EFF T-1	EA	1	CR01
006	65610-124 990017-991	22526	TERM STRIP 24PIN DBL ROW	EA	1	J01
007	553-3635-33 760043-470	71279	COIL FIXED 470UH 10%	EA	1	L01
008	2N2222A 780000-002B	80131	XSTR NPN HI-SPD MED PWR	EA	4	Q01-04
009	CF1/8-470-OHMS/J 744052-470	09021	RES FILM 470-OHM 1/8W 5%	EA	4	R01-04
010	CF1/8-56-OHMS/J 744051-560	09021	RES FILM 56-OHM 1/8W 5%	EA	1	R05
011	HPDL-2416 990018-642	28480	LED	EA	6	U01-06
012	627607-809 627607-809	14482	IC-74C911 CT PLSTC DIP	EA	1	U07
013	4116R-001-560 990017-996	80294	RES NET DIP 16P 56-OHM 2%	EA	2	U08 13
014	HDSP-4820 990018-640	28480	LED	EA	1	U09
015	HLMP-2600 990018-641	28480	LED	EA	2	U10 11
016	627607-359 627607-359	14482	IC-74HC138 CT PLSTC DIP	EA	1	U12
026	659483 659483	14482	SCHEM DIAG	EA	REF	

EXPLOSION FINISHED

Figure 5-2. Front Panel Display CCA A1 Parts List, Part No. 659480 (Sheet 3 of 3)



4 MOUNT P1 FROM PWB SIDE

3 MARK DASH NUMBER PER MIL-STD-130 APPROXIMATELY WHERE SHOWN USING .12 HIGH CHARACTERS WITH BLACK INK COLOR NO 17038 PER FED-STD-595

2. OBSERVE POLARITY OF CAPACITORS AND SEMICONDUCTOR DEVICES

1. SOLDER PER MIL-STD-454

NOTES: UNLESS OTHERWISE SPECIFIED

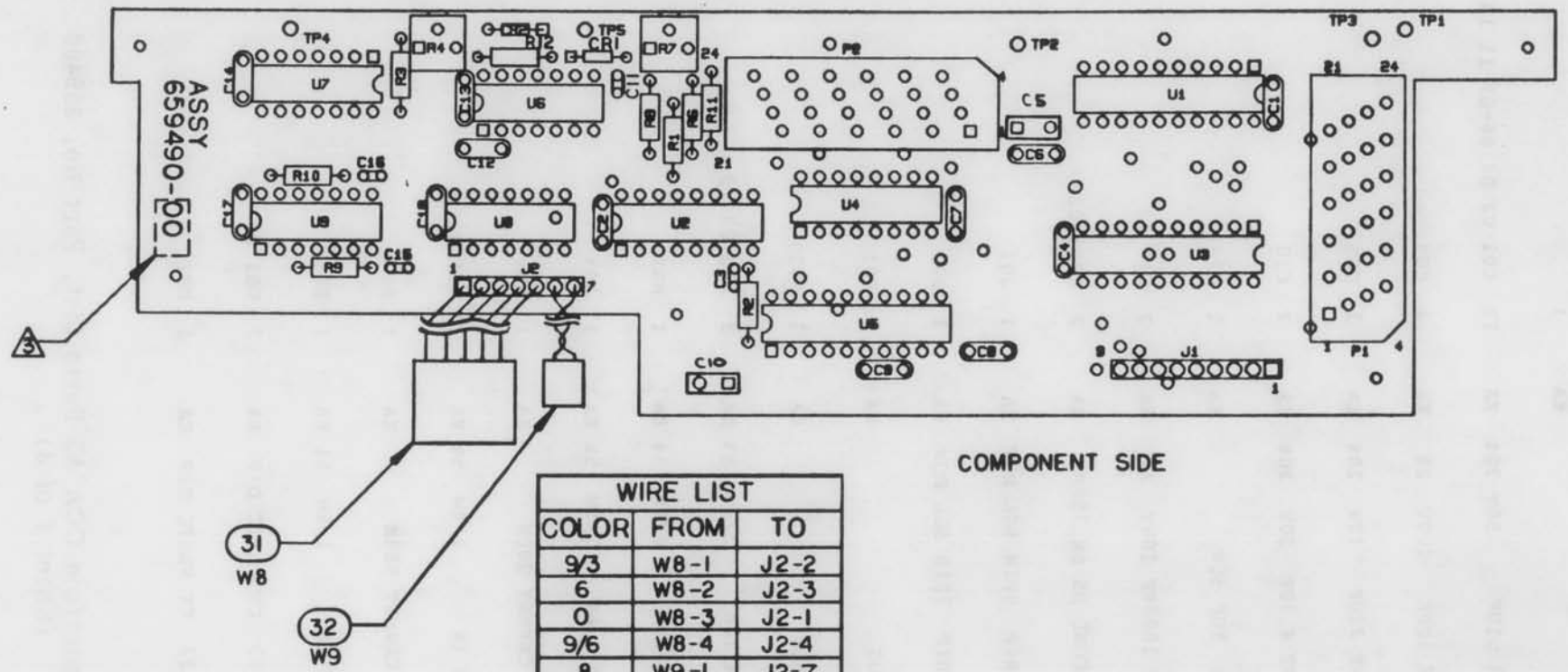
Figure 5-3. Front Panel Keyboard CCA A2 Parts List, Part No. 659484 (Sheet 1 of 3)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
001	659485-001 659485-001	14482	PWB	EA	1	
003	659488-001 659488-001	14482	SW MEM BLK	EA	1	
004	659488-002 659488-002	14482	SW COR BLK/LEVEL BLK	EA	1	S02
005	659488-003 659488-003	14482	SW 7 RED/RF BLK/ATTN BLK	EA	1	S03
006	659488-004 659488-004	14482	SW 8 RED/IF BLK/BW BLK	EA	1	S04
007	659488-005 659488-005	14482	SW 9 RED/TUNE BLK/RATE BK	EA	1	S05
008	659488-006 659488-006	14482	SW 0 RED/FREQ BLK	EA	1	S06
009	659488-007 659488-007	14482	SW BLK/INC BLK	EA	1	S07
010	659488-008 659488-008	14482	SW LKOT RED/STORE BLK	EA	1	S08
011	659488-009 659488-009	14482	SW DEL RED/EXEC BLK	EA	1	S09
012	659488-010 659488-010	14482	SW 4 RED/AGC BLK	EA	1	S10
013	659488-011 659488-011	14482	SW 5 RED/AFC BLK	EA	1	S11
014	659488-012 659488-012	14482	SW 6 RED/DET BLK/MODE BLK	EA	1	S12
015	659488-013 659488-013	14482	SW . RED/MENU BLK	EA	1	S13
016	659488-014 659488-014	14482	SW DEC BLK/ BLK	EA	1	S14
017	659488-015 659488-015	14482	SW LOCAL BLK	EA	1	S15
018	659488-016 659488-016	14482	SW 1 RED/MAN BLK	EA	1	S16
019	659488-017 659488-017	14482	SW 2 RED/STEP BLK	EA	1	S17
020	659488-018 659488-018	14482	SW 3 RED/SCAN BLK	EA	1	S18
021	659488-019 659488-019	14482	SW ENTER BLK	EA	1	S19
022	659488-020 659488-020	14482	SW SHIFT RED	EA	1	S20

Figure 5-3. Front Panel Keyboard CCA A2 Parts List, Part No. 659484
(Sheet of 2 of 3)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
023	659489-001 659489-001	14482	ASSY-CABLE FLEX	SCD EA	1	P1
026	659487 659487	14482	SCHEM DIAG	EA	REF	
			EXPLOSION FINISHED			

Figure 5-3. Front Panel Keyboard CCA A2 Parts List, Part No. 659484
(Sheet of 3 of 3)



COMPONENT SIDE

WIRE LIST		
COLOR	FROM	TO
9/3	W8-1	J2-2
6	W8-2	J2-3
0	W8-3	J2-1
9/6	W8-4	J2-4
8	W9-1	J2-7
9	W9-2	J2-6

NOTES:

1. PARTS LIST REFER PL 659490
2. MAXIMUM COMPONENT HEIGHT ABOVE BOARD .40
3. MARK APPROPRIATE DASH NUMBER AFTER ASSEMBLY.
4. SOLDER PER MIL-STD-454

659490B

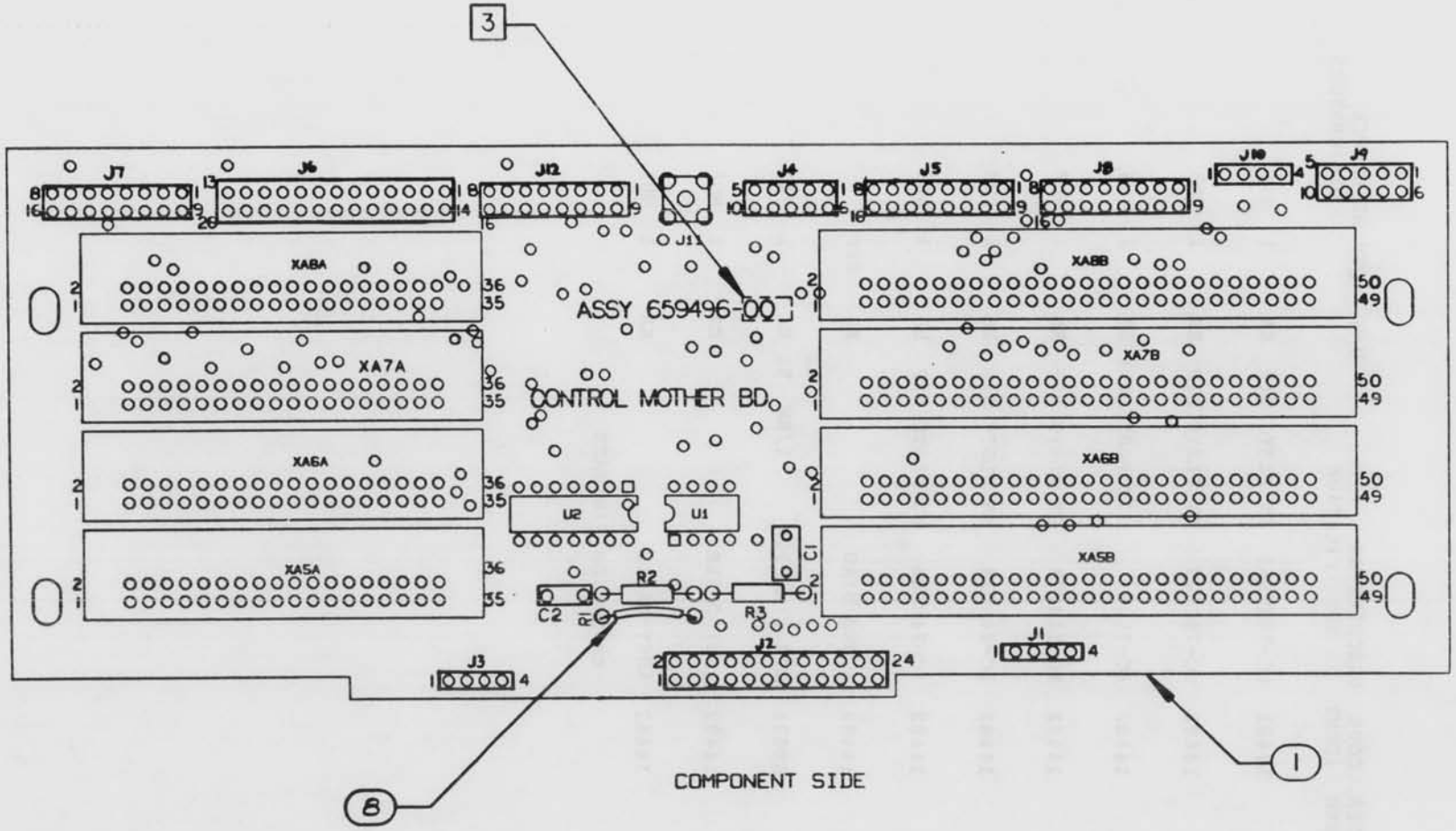
Figure 5-4. Front Panel Interface CCA A3 Parts List, Part No. 659490 (Sheet 1 of 3)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS REV. A
001	659491-001 659491-001	14482	PWB	EA	1	
003	660073-104 660073-104	14482	CAP CER .1UF 50V 20%	EA	12	C01 02 04 06-09 11 13 14 17 18
004	100-100-NP0-100G 759161-100	51642	CAP CER 10PF 100V 2%	EA	1	C03
005	MML-010-226R-20 990017-942	14674	CAP TANT 22UF 10V 20%	EA	1	C05
006	MMM-020-475R-20 990017-943	14674	CAP TANT 4.7UF 20V 20%	EA	1	C10
007	C330C105M5V5CA 752100-100	59660	CAP CER 1UF 50V	EA	1	C12
008	150-100-NP0-102G 759163-100	51642	CAP CER 1000PF 100V 2%	EA	2	C15 16
009	1N4449 775000-001	80131	DIO HI COND HS SW 75PPV	EA	2	CR01 02
010	65500-109 990018-213	22526	TERM STRIP 9PIN SGL ROW	EA	1	J01
011	65500-107 990018-214	22526	TERM STRIP 7PIN SGL ROW	EA	1	J02
012	659494-001 659494-001	14482	ASSY-PLUG	EA	1	P01
013	659495-001 659495-001	14482	ASSY-CABLE	EA	1	P02
014	CF1/8-10K/J 744054-100	09021	RES FILM 10K 1/8W 5%	EA	3	R01 09 10
015	CF1/8-39K/J 744054-390	09021	RES FILM 39K 1/8W 5%	EA	1	R02
016	CF1/8-5.6K/J 744053-560	09021	RES FILM 5.6K 1/8W 5%	EA	1	R03
017	3329W-200K 990018-864	80294	RES VAR CERMET 200K	EA	1	R04
018	CF1/8-1K/J 744053-100	09021	RES FILM 1K 1/8W 5%	EA	2	R06 11
019	3329W-500K 990018-865	80294	RES VAR CERMET 500K	EA	1	R07
020	CF1/8-180K/J 744055-180	09021	RES FILM 180K 1/8W 5%	EA	1	R08
021	627607-641 627607-641	14482	IC-74HC373 CT PLSTC DIP	EA	2	U01 03
022	627607-394 627607-394	14482	IC-74LS123 CT PLSTC DIP	EA	1	U02

Figure 5-4. Front Panel Interface CCA A3 Parts List, Part No. 659490
(Sheet 2 of 3)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
023	627607-659 627607-659	14482	IC-74HC365 CT PLSTC DIP	EA	1	U04
024	627607-788 627607-788	14482	IC-74C923 CT PLSTC DIP	EA	1	U05
025	627607-674 627607-674	14482	IC-7556 IT PLSTC DIP	EA	1	U06
026	627607-175 627607-175	14482	IC-74HC74 CT PLSTC DIP	EA	1	U07
027	627607-531 627607-531	14482	IC-74HC14 CT PLSTC DIP	EA	1	U08
028	627607-192 627607-192	14482	IC-74HC86 CT PLSTC DIP	EA	1	U09
029	659493 659493	14482	SCHEM DIAG	EA	REF	
030	CF1/8-22K/J 744054-220	09021	RES FILM 22K 1/8W 5%	EA	1	R12
031	660179-008 660179-008	14482	ASSY-CABLE	EA	1	W08
032	660179-009 660179-009	14482	ASSY-CABLE	EA	1	W09
			EXPLOSION FINISHED			

Figure 5-4. Front Panel Interface CCA A3 Parts List, Part No. 659490
(Sheet 3 of 3)



NOTES: **UNLESS OTHERWISE SPECIFIED:**

1. PARTS LIST REFER PL 659496.
2. MAXIMUM COMPONENT HEIGHT ABOVE BOARD .55 .
3. MARK APPROPRIATE DASH NUMBER AFTER ASSEMBLY PER MIL-STD-130.
4. OBSERVE ORIENTATION OF COMPONENTS.

Figure 5-5. Control Mother Board A4 Parts List, Part No. 659496 (Sheet 1 of 2)

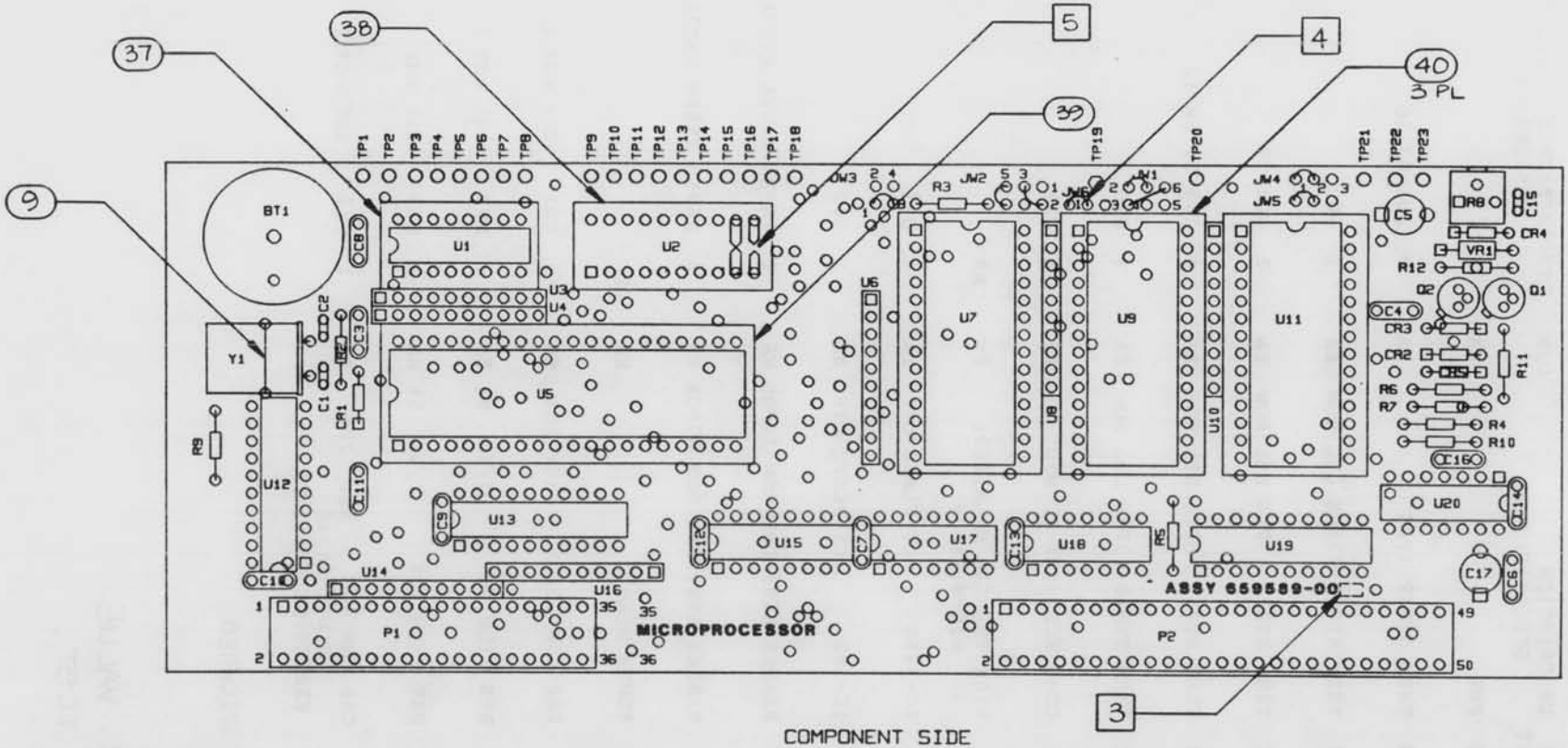
659496A

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS REV. A	
001	659497-001 659497-001	14482	PWB	EA	1		
002	TSW-104-08-GD 990018-866	55322	TERM STRIP 4POS	EA	3	J01 03 10	
003	TSW-112-08-GD 990018-867	55322	TERM STRIP 12POS DBL ROW	EA	1	J02	
004	TSW-105-08-GD 990018-868	55322	TERM STRIP 5POS DBL ROW	EA	2	J04 09	
005	TSW-108-08-GD 990018-869	55322	TERM STRIP 8POS DBL ROW	EA	4	J05 07 08 12	
006	TSW-113-08-GD 990018-870	55322	TERM STRIP 13POS DBL ROW	EA	1	J06	
007	50-651-0000-31 990017-986	98291	CONN RCPT SMA PC MTG	EA	1	J11	
008	24AWG-TY-E-5 430240-005		WIRE TFL GRN MILW16878 MIL-W-16878	FT	AR		
009	627601-063 627601-063	14482	IC-1458 CT PLSTC DIP	EA	1	U01	
010	627603-254 627603-254	14482	IC-300 CT PLSTC DIP	EA	1	U02	
011	67274-018 990017-987	22526	HEADER ASSY DBL ROW 36POS	EA	4	XA05A XA06A XA07A XA08A	
012	67274-025 990017-988	22526	HEADER ASSY DBL ROW 50POS	EA	4	XA05B XA06B XA07B XA08B	
013	659499 659499	14482	SCHEM DIAG	EA	REF		
014	660073-103 660073-103	14482	CAP CER .01UF 50V 20%	EA	1	C01	SEE NOTE 1
015	CF1/4-1K/J 744073-100	09021	RES FILM 1K 1/4W 5%	EA	1	R02	SEE NOTE 1
016	CF1/4-10K/J 744074-100	09021	RES FILM 10K 1/4W 5%	EA	1	R03	SEE NOTE 1
017	CK06BX105K 070716-000		CAP CER 1UF 50V 10% MIL-C-11015 EXPLOSION FINISHED	EA	1	C02	SEE NOTE 1

NOTES: UNLESS OTHERWISE SPECIFIED

1. FACTORY SELECT. VALUE DETERMINED AT TEST.

Figure 5-5. Control Mother Board A4 Parts List, Part No. 659496
(Sheet 2 of 2)



COMPONENT SIDE

659589A

5 BEFORE INSTALLING JUMPER PACK, CUT JUMPER BETWEEN PINS 10 AND 11

4 INSTALL JUMPERS USING ITEM 9, 8 PLACES

3 MARK DASH NUMBER PER MIL-STD-130 APPROXIMATELY WHERE SHOWN USING .12 HIGH CHARACTERS WITH BLACK INK COLOR NO 17038 PER FED-STD-595

2. OBSERVE POLARITY OF CAPACITORS AND SEMICONDUCTOR DEVICES

1. SOLDER PER MIL-STD-454

NOTES: UNLESS OTHERWISE SPECIFIED

Figure 5-6. Microprocessor A5 Parts List, Part No. 659589 (Sheet 1 of 4)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS REV. A
001	796495-P1 659590-001	14482	PWB	EA	1	
002	1935 990018-649	00681	BATTERY LITHIUM IODINE	EA	1	BT01
003	150-100-NP0-2706 759161-270	51642	CAP CER 27PF 100V 2%	EA	2	C01 02
004	660073-103 660073-103	14482	CAP CER .01UF 50V 20%	EA	9	C03 04 06-11 16
005	196D226X0010JE3 990018-650	56289	CAP TANT 22UF 10V 20%	EA	2	C05 17
006	660073-104 660073-104	14482	CAP CER .1UF 50V 20%	EA	3	C12-14
007	150-100-NP0-1026 759163-100	51642	CAP CER 1000PF 100V 2%	EA	1	C15
008	5082-2800 775000-002	28480	DIO HOT CARRER 1/4W 70V	EA	5	CR01-05
009	22AWG-QQW343 442222-000		WIRE BUS SOLID TINNED CU QQ-W-343	FT	AR	JW01-06
010	66527-018 990018-329	22526	RCPT ASSY DBL ROW 36POS	EA	1	P01
011	66527-025 990018-330	22526	RCPT ASSY DBL ROW 50POS	EA	1	P02
012	2N2222A 780000-002B	80131	XSTR NPN HI-SPD MED PWR	EA	1	Q01
013	2N2907A 780000-001B		XSTR PNP HI-SPD MED PWR	EA	1	Q02
014	CF1/8-300K/J 744055-300	09021	RES FILM 300K 1/8W 5%	EA	1	R02
015	CF1/8-100K/J 744055-100	09021	RES FILM 100K 1/8W 5%	EA	5	R03-05 09 11
016	CF1/8-1M/J 744056-100	09021	RES FILM 1.0M 1/8W 5%	EA	1	R06
017	CMF-55 741556-681	91637	RES FILM 6.81M 1/10W 1%	EA	1	R07
018	3329W-1-502 990018-790	80294	RES VAR CERMET 5K 20%	EA	1	R08
019	CF1/8-150K/J 744055-150	09021	RES FILM 150K 1/8W 5%	EA	1	R10

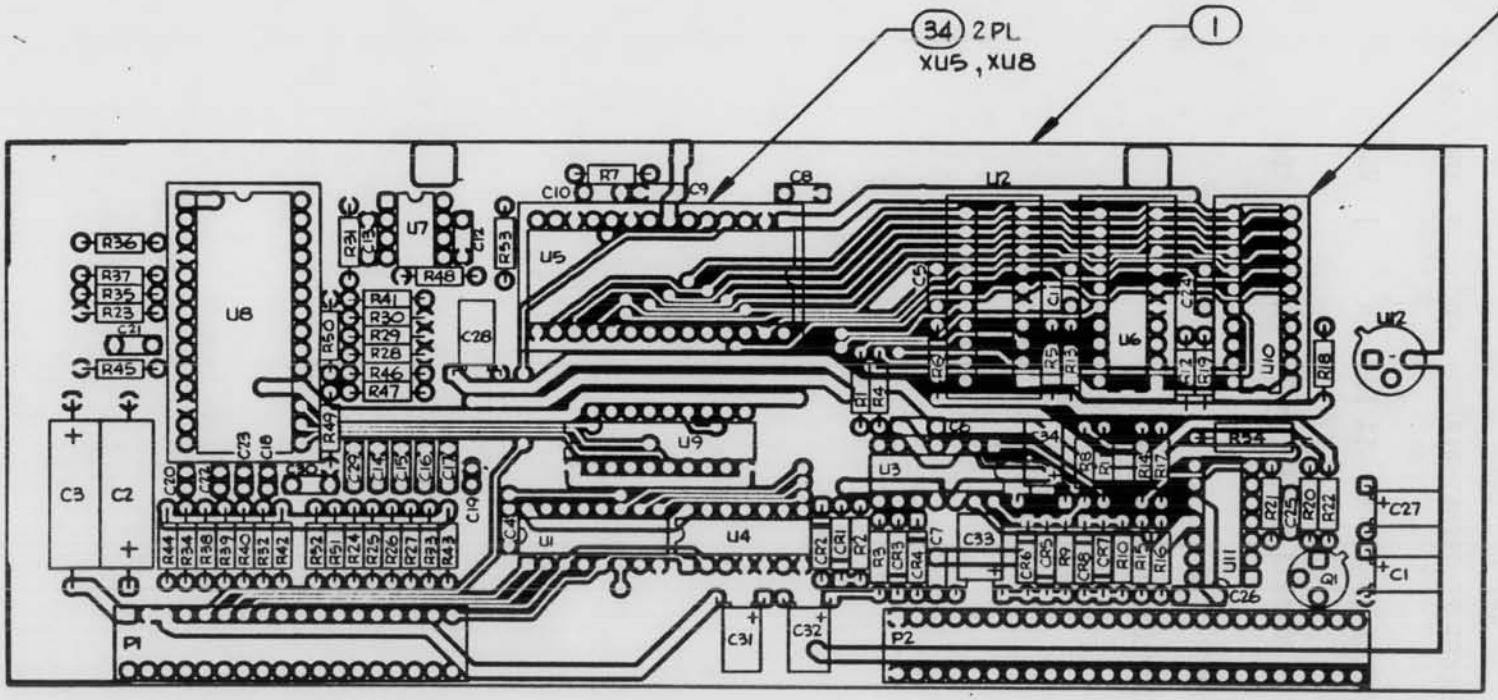
Figure 5-6. Microprocessor A5 Parts List, Part No. 659589 (Sheet 2 of 4)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
020	CF1/8-2.2K/J 744053-220	09021	RES FILM 2.2K 1/8W 5%	EA	1	R12
021	633000-096 633000-096	14482	IC-PROM 32X8TS55 C D	EA	1	U01
023	1-435704-0 990018-474	00779	PROGRAMMABLE SHUNT (DIP)	EA	1	U02
024	110A102 990018-656	01121	RES NET SIP 10P 1K 2%	EA	1	U03
025	110A103 990018-473	01121	RES NET SIP 10P 10K 2%	EA	1	U04
026	627606-095 627606-095	14482	IC-68B09 CT PLSTC DIP	EA	1	U05
027	110A104 990018-657	01121	RES NET SIP 10P 100K 2%	EA	3	U06 08 10
028	633000-041 633000-041	14482	IC-PROM 32KX8TS250 C D	EA	2	U07 09
029	633000-038 633000-038	14482	IC-PROM 8192X8TS150 C D	EA	1	U11
030	627607-638 627605-603A	14482	IC-74HCT244 CT PLSTC DIP	EA	2	U12 13
031	110A223 990018-331	01121	RES NET SIP 10P 22K 2%	EA	2	U14 16
032	627607-363 627607-363	14482	IC-74HCT139 CT PLSTC DIP	EA	1	U15
033	627607-827 627607-827	14482	IC-74ALS32N CT PLSTC DIP	EA	1	U17
034	627607-102 627607-102	14482	IC-74ALS04 CT PLSTC DIP	EA	1	U18
035	627607-720 627607-720	14482	IC-74HCT245 CT PLSTC DIP	EA	1	U19
036	627607-076 627607-076	14482	IC-74C00 CT PLSTC DIP	EA	1	U20
037	516-AG10D 990009-646A	91506	SOCKET PC 16CONT DIP	EA	1	XU01
038	520-AG10D 990018-658	91506	SOCKET PC 20CONT DIP	EA	1	XU02
039	540-AG10D 990018-325	91506	SOCKET PC 40CONT DIP	EA	1	XU05

Figure 5-6. Microprocessor A5 Parts List, Part No. 659589 (Sheet 3 of 4)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
040	528-A610D 990018-659	91506	SOCKET PC 28CONT DIP	EA	3	XU07 09 11
041	1N746A 771000-016		DIO ZR 3.3V .4W 5% DO7	EA	1	VR01
043	MP042 990018-660	75378	XTAL/QUARTZ 4.91520 MHZ	EA	1	Y01
052	580472 659592	14482	SCHEM DIAG	EA	REF	
			EXPLOSION FINISHED			

Figure 5-6. Microprocessor A5 Parts List, Part No. 659589 (Sheet 4 of 4)



659501A

3 MARK DASH NUMBER PER MIL-STD-130 APPROXIMATELY WHERE SHOWN USING .12 HIGH CHARACTERS WITH WHITE INK COLOR NO 17875 PER FED-STD-595.

2. OBSERVE POLARITY OF CAPACITORS AND SEMICONDUCTOR DEVICES.

1. SOLDER PER MIL-STD-454

NOTES: UNLESS OTHERWISE SPECIFIED

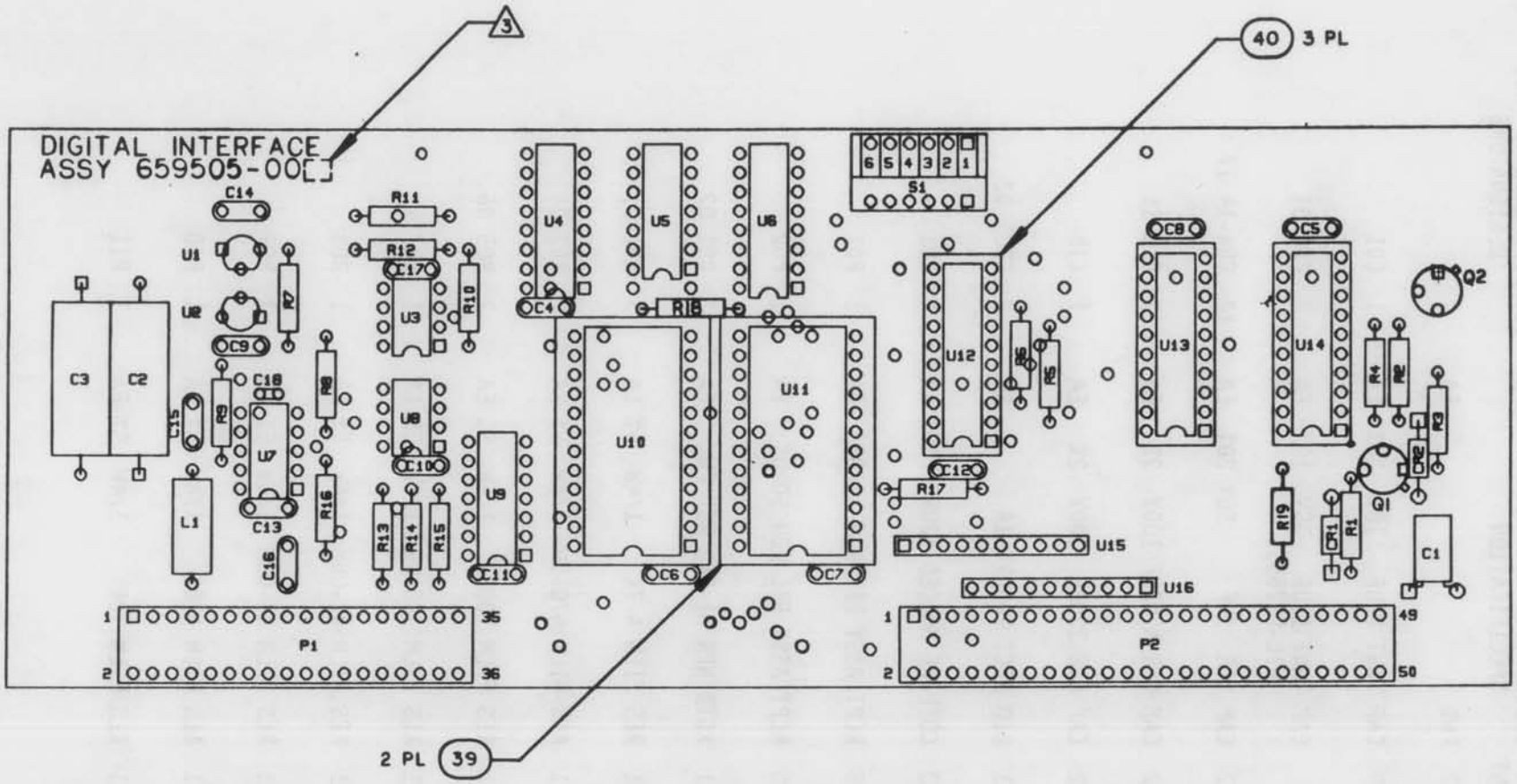
Figure 5-7. Analog Interface CCA A6 Parts List, Part No. 659501 (Sheet 1 of 3)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS REV. B
001	659502-001 659502-001	14482	PWB	EA	1	
002	196D226X0010JE3 990018-650	56289	CAP TANT 22UF 10V 20%	EA	1	C01
003	CS13BF186K 754057-180		CAP TANT 18UF 35V 10% MIL-C-26655	EA	2	C02 03
004	660073-104 660073-104	14482	CAP CER .1UF 50V 20%	EA	17	C04-08 10-13 16 17 21 24-26 29 C30
005	660073-103 660073-103	14482	CAP CER .01UF 50V 20%	EA	3	C09 14 15
006	150-100-NP0-102G 759163-100	51642	CAP CER 1000PF 100V 2%	EA	5	C18-20 22 23
007	196D475X0035JE3 990018-349	56289	CAP TANT 4.7UF 35V 20%	EA	6	C27 28 31-34
008	66527-018 990018-329	22526	RCPT ASSY DBL ROW 36POS	EA	1	P01
009	66527-025 990018-330	22526	RCPT ASSY DBL ROW 50POS	EA	1	P02
010	JAN2N2907 780000-001C		XSTR MIL-S-19500	EA	1	Q01
011	RN55C5620F 741552-562		RES FILM 562-OHM 1/10W 1% MIL-R-10509	EA	12	R01 04-06 08 11-14 17-19
012	CF1/4-100-OHMS/J 744072-100	09021	RES FILM 100-OHM 1/4W 5%	EA	2	R15 16
013	RN55C51R1F 741551-511		RES FILM 51.1OHM 1/10W 1% MIL-R-10509	EA	1	R07
014	RN55C2212F 741554-221		RES FILM 22.1K 1/10W 1% MIL-R-10509	EA	2	R20 22
015	CF1/4-15K/J 744074-150	09021	RES FILM 15K 1/4W 5%	EA	1	R21
016	RN55C1502F 741554-150		RES FILM 15K 1/10W 1% MIL-R-10509	EA	5	R23 26 37 51 52
017	CF1/4-10K/J 744074-100	09021	RES FILM 10K 1/4W 5%	EA	6	R27 29 39 40 46 47
018	CF1/4-20K/J 744074-200	09021	RES FILM 20K 1/4W 5%	EA	3	R28 31 45
019	RN55C3012F 741554-301		RES FILM 30.1K 1/10W 1% MIL-R-10509	EA	5	R30 35 49 50 41
020	CF1/4-1K/J 744073-100	09021	RES FILM 1K 1/4W 5%	EA	6	R02 03 09 10 24 38
021	RN55C6192F 741554-619		RES FILM 61.9K 1/10W 1% MIL-R-10509	EA	1	R36

Figure 5-7. Analog Interface CCA A6 Parts List, Part No. 659501
(Sheet 2 of 3)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
022	RN55C1002F 741554-100		RES FILM 10K 1/10W 1% MIL-R-10509	EA	3	R32-34
023	RN55C1503F 741555-150		RES FILM 150K 1/10W 1%	EA	3	R42-44
024	627607-359 627607-359	14482	IC-74HC138 CT PLSTC DIP	EA	1	U01
025	627607-793 627607-793	14482	IC-7528 CT PLSTC DIP	EA	3	U02 06 10
026	627603-136 627603-136	14482	IC-3403 CT PLSTC DIP	EA	2	U03 11
027	627607-826 627607-826	14482	IC-74HC32 CT PLSTC DIP	EA	1	U04
028	627605-709 627605-709	14482	IC-574 CT PLSTC DIP	EA	1	U05
029	627603-325 627603-325	14482	IC-34001P CT PLSTC DIP	EA	1	U07
030	627606-102 627606-102	14482	IC-6116 CT PLSTC DIP	EA	1	U08
031	627607-642 627607-642	14482	IC-74HC374 CT PLSTC DIP	EA	1	U09
032	627605-712 627605-712	14482	IC-581 CT MET CAN	EA	1	U12
033	ICN-203-S3-T 990018-351	06776	SOCKET IC 20PIN DIP	EA	3	XU02 06 10
034	ICN-286-S5-T 990018-352	06776	SOCKET IC 28PIN DIP	EA	2	XU05 08
035	659504 659504	14482	SCHEM DIAG	EA	REF	
036	1N4449 775000-001	80131	DIO HI COND HS SW 75PPV	EA	8	CR01-08
037	CF1/4-13K/J 744074-130	09021	RES FILM 13K 1/4W 5%	EA	1	R25
038	RN60C2212F 741604-221		RES FILM 22.1K 1/8W 1% MIL-R-10509	EA	1	R54
039	RN55C1001F 741553-100		RES FILM 1K 1/10W 1% MIL-R-10509	EA	2	R48 53
			EXPLOSION FINISHED			

Figure 5-7. Analog Interface CCA A6 Parts List, Part No. 659501 (Sheet 3 of 3)



COMPONENT SIDE

NOTES:

1. PARTS LIST REFER PL 659505
2. MAXIMUM COMPONENT HEIGHT ABOVE BOARD .40
3. MARK APPROPRIATE DASH NUMBER AFTER ASSEMBLY.
4. **SOLDER PER MIL-STD-454 REQUIREMENTS**

659505A

Figure 5-8. Digital Interface CCA A7 Parts List, Part No. 659505 (Sheet 1 of 4)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
			REV. B			
001	659506-001 659506-001	14482	PWB	EA	1	
002	196D226X0010JE3 990018-650	56289	CAP TANT 22UF 10V 20%	EA	1	C01
003	CS13BF186K 754057-180		CAP TANT 18UF 35V 10% MIL-C-26655	EA	2	C02 03
004	660073-104 660073-104	14482	CAP CER .1UF 50V 20%	EA	12	C04-14 17
005	300-100-NP0-4726 759163-470	51642	CAP CER 4700PF 100V 2%	EA	2	C15 16
006	150-100-NP0-2216 759162-220	51642	CAP CER 220PF 100V 2%	EA	1	C18
007	1N4003 773000-006	80131	DIO RECT 200PRV 1A	EA	2	CR01 02
008	1537-38 760052-120	99800	COIL RF MOLDED 12UH 10%	EA	1	L01
009	66527-018 990018-329	22526	RCPT ASSY DBL ROW 36POS	EA	1	P01
010	66527-025 990018-330	22526	RCPT ASSY DBL ROW 50POS	EA	1	P02
011	2N2222A 780000-002B	80131	XSTR NPN HI-SPD MED PWR	EA	2	Q01 02
012	CF1/4-4.7K/J 744073-470	09021	RES FILM 4.7K 1/4W 5%	EA	3	R01 03 13
013	CF1/4-470-OHMS/J 744072-470	09021	RES FILM 470-OHM 1/4W 5%	EA	2	R02 04
014	CF1/4-100K/J 744075-100	09021	RES FILM 100K 1/4W 5%	EA	2	R05 06
015	CF1/4-100-OHMS/J 744072-100	09021	RES FILM 100-OHM 1/4W 5%	EA	1	R07
016	CF1/4-47-OHMS/J 744071-470	09021	RES FILM 47-OHM 1/4W 5%	EA	1	R08
017	CF1/4-43-OHMS/J 744071-430	09021	RES FILM 43-OHM 1/4W 5%	EA	1	R09
018	CF1/4-470K/J 744075-470	09021	RES FILM 470K 1/4W 5%	EA	1	R10
019	CF1/4-30K/J 744074-300	09021	RES FILM 30K 1/4W 5%	EA	1	R11

Figure 5-8. Digital Interface CCA A7 Parts List, Part No. 659505
(Sheet 2 of 4)

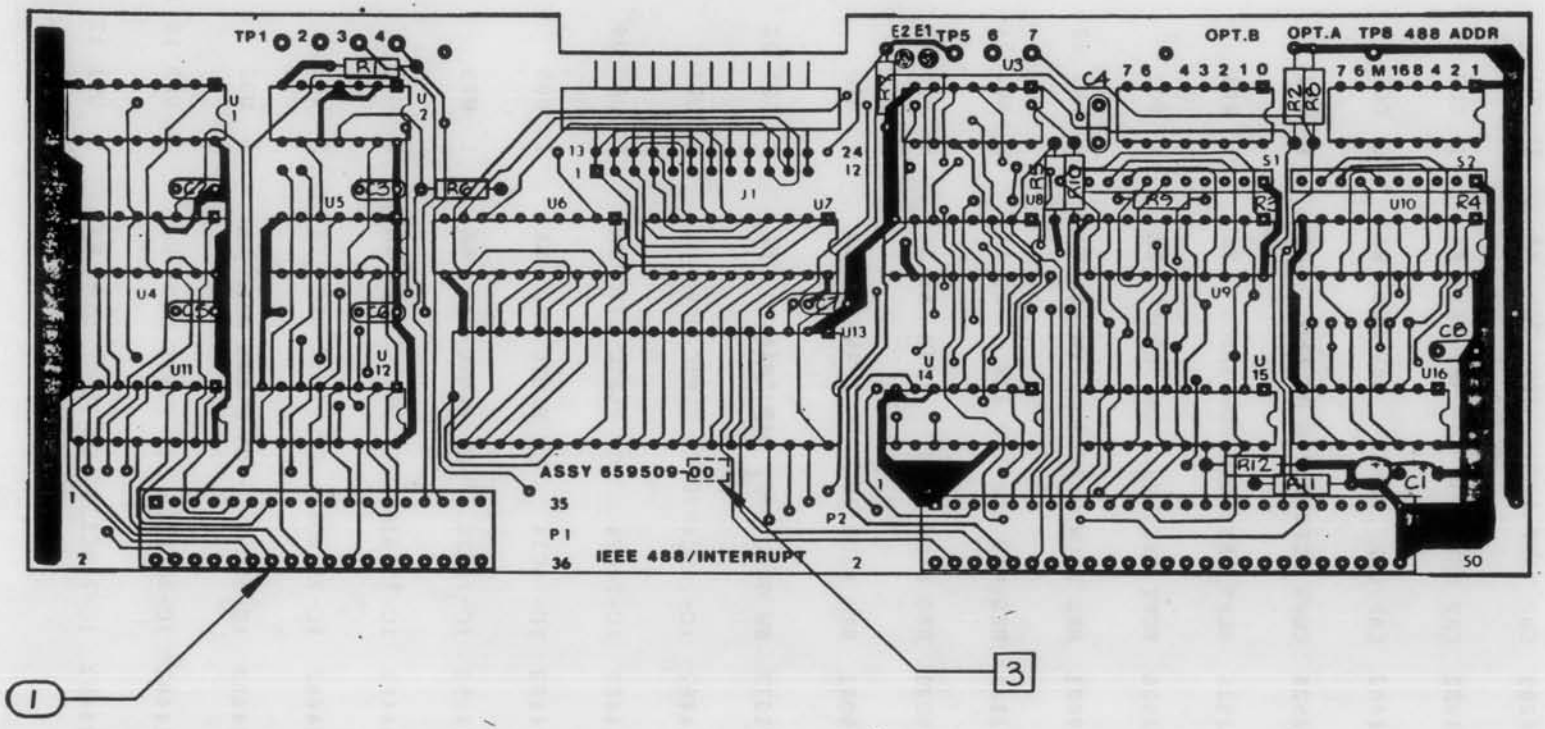
ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
020	CF1/4-11K/J 744074-110	09021	RES FILM 11K 1/4W 5%	EA	1	R12
021	CF1/4-15K/J 744074-150	09021	RES FILM 15K 1/4W 5%	EA	2	R14 15
022	CF1/4-10-OHMS/J 744071-100	09021	RES FILM 10-OHM 1/4W 5%	EA	1	R16
023	CF1/4-47K/J 744074-470	09021	RES FILM 47K 1/4W 5%	EA	1	R17
024	76PSB06S 990018-338	81073	SW 6 SPST DIP "PIANO"	EA	1	S01
025	627607-699 627607-699	14482	IC-79L12 CT PLSTC DIP	EA	1	U01
026	627607-781 627607-781	14482	IC-78L12 CT PLSTC DIP	EA	1	U02
027	627607-795 627607-795	14482	IC-75140 CT PLSTC DIP	EA	1	U03
028	627607-359 627607-359	14482	IC-74HC138 CT PLSTC DIP	EA	1	U04
029	627607-103 627607-103	14482	IC-74HC04 CT PLSTC DIP	EA	1	U05
030	627604-055 627604-055	14482	IC-4040 CT PLSTC DIP	EA	1	U06
031	627602-003 627602-003	14482	IC-0002 CT PLSTC DIP	EA	1	U07
032	627607-293 627607-293	14482	IC-75150 CT PLSTC DIP	EA	1	U08
033	627607-472 627607-472	14482	IC-75189 CT PLSTC DIP	EA	1	U09
034	627606-096 627606-096	14482	IC-68B50 CT PLSTC DIP	EA	2	U10 11
035	627607-641 627607-641	14482	IC-74HC373 CT PLSTC DIP	EA	1	U12
036	627607-642 627607-642	14482	IC-74HC374 CT PLSTC DIP	EA	2	U13 14
037	110A104 990018-657	01121	RES NET SIP 10P 100K 2%	EA	1	U15
038	110A223 990018-331	01121	RES NET SIP 10P 22K 2%	EA	1	U16

Figure 5-8. Digital Interface CCA A7 Parts List, Part No. 659505 (Sheet 3 of 4)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
039	524-A611D 090589-000	91506	SOCKET PC 24CONT DIP	EA	2	XU10 11
040	520-A637D 990009-155	91506	SOCKET PC 20CONT DIP	EA	3	XU12-14
052	659508 659508	14482	SCHEM DIAG	EA	REF	
053	CF1/4-2.2K/J 744073-220	09021	RES FILM 2.2K 1/4W 5%	EA	1	R18
054	CF1/4-1K/J 744073-100	09021	RES FILM 1K 1/4W 5%	EA	1	R19

EXPLOSION FINISHED

Figure 5-8. Digital Interface CCA A7 Parts List, Part No. 659505
(Sheet 4 of 4)



3 MARK DASH NUMBER PER MIL-STD-130 APPROXIMATELY WHERE SHOWN USING .12 HIGH CHARACTERS WITH BLACK INK COLOR NO 17038 PER FED-STD-595.

2. OBSERVE POLARITY OF CAPACITORS AND SEMICONDUCTOR DEVICES

1. SOLDER PER MIL-STD-454

NOTES: UNLESS OTHERWISE SPECIFIED

Figure 5-9. IEEE/488 Interrupt CCA A8 Parts List, Part No. 659509 (Sheet 1 of 3)

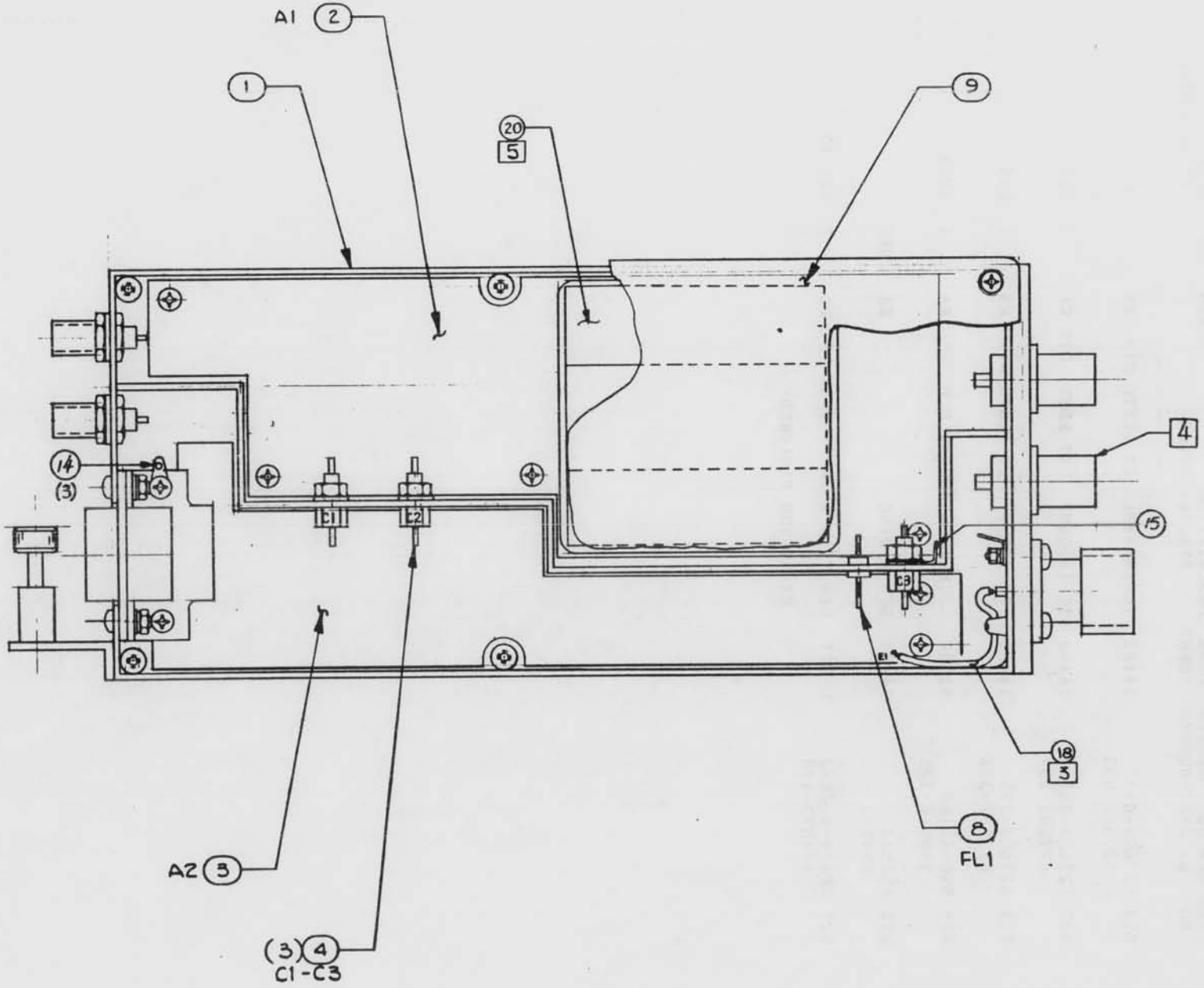
ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
			REV. A			
001	659510-001 659510-001	14482	PWB	EA	1	
002	196D476X9020PE4 990018-332	56289	CAP TANT 47UF 20V 20%	EA	1	C01
003	660073-104 660073-104	14482	CAP CER .1UF 50V 20%	EA	3	C02-04
004	660073-103 660073-103	14482	CAP CER .01UF 50V 20%	EA	4	C05-08
005	65624-124 990018-328	22526	CONN RCPT 24PIN RT ANG	EA	1	J01
006	66527-018 990018-329	22526	RCPT ASSY DBL ROW 36POS	EA	1	P01
007	66527-025 990018-330	22526	RCPT ASSY DBL ROW 50POS	EA	1	P02
008	CF1/4-2.7M/J 744076-270	09021	RES FILM 2.7MEG 1/4W 5%	EA	2	R01 02
009	110A223 990018-331	01121	RES NET SIP 10P 22K 2%	EA	2	R03 04
010	CF1/4-100K/J 744075-100	09021	RES FILM 100K 1/4W 5%	EA	5	R05-09
011	CF1/4-10K/J 744074-100	09021	RES FILM 10K 1/4W 5%	EA	1	R10
012	76PSB08S 990018-326	81073	SW OCTL SPST DIP "PIANO"	EA	2	S01 02
013	627607-159 627607-159	14482	IC-74HC4020 CT PLSTC DIP	EA	1	U01
014	627607-170 627607-170	14482	IC-74C74 CT PLSTC DIP	EA	2	U02 04
015	627607-532 627607-532	14482	IC-74C14 CT PLSTC DIP	EA	1	U03
016	627607-132 627607-132	14482	IC-74C20 CT PLSTC DIP	EA	1	U05
017	627607-803 627607-803	14482	IC-75161A CT PLSTC DIP	EA	1	U06
018	627607-754 627607-754	14482	IC-75160A CT PLSTC DIP	EA	1	U07
019	627608-207 627608-207	14482	IC-80C97 CT PLSTC DIP	EA	1	U08
020	627607-641 627607-641	14482	IC-74HC373 CT PLSTC DIP	EA	3	U09 10 15
021	627607-359 627607-359	14482	IC-74HC138 CT PLSTC DIP	EA	2	U11 12

Figure 5-9. IEEE/488 Interrupt CCA A8 Parts List, Part No. 659509 (Sheet 2 of 3)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
022	627606-093 627606-093	14482	IC-68B488L CT PLSTC DIP	EA	1	U13
023	627601-257 627601-257	14482	IC-14506B IT PLSTC DIP	EA	1	U14
024	627607-376 627607-376	14482	IC-74C174 CT PLSTC DIP	EA	1	U16
025	540-AG10D 990018-325	91506	SOCKET PC 40CONT DIP	EA	1	XU13
026	659512 659512	14482	SCHEM DIAG	EA	REF	
027	CF1/4-4.7K/J 744073-470	09021	RES FILM 4.7K 1/4W 5%	EA	2	R11 12

EXPLOSION FINISHED

Figure 5-9. IEEE/488 Interrupt CCA A8 Parts List, Part No. 659509 (Sheet 3 of 3)



659513A/1

Figure 5-10. 10 MHz Reference Generator/MUX A9 Parts List, Part No. 659513 (Sheet 1 of 3)

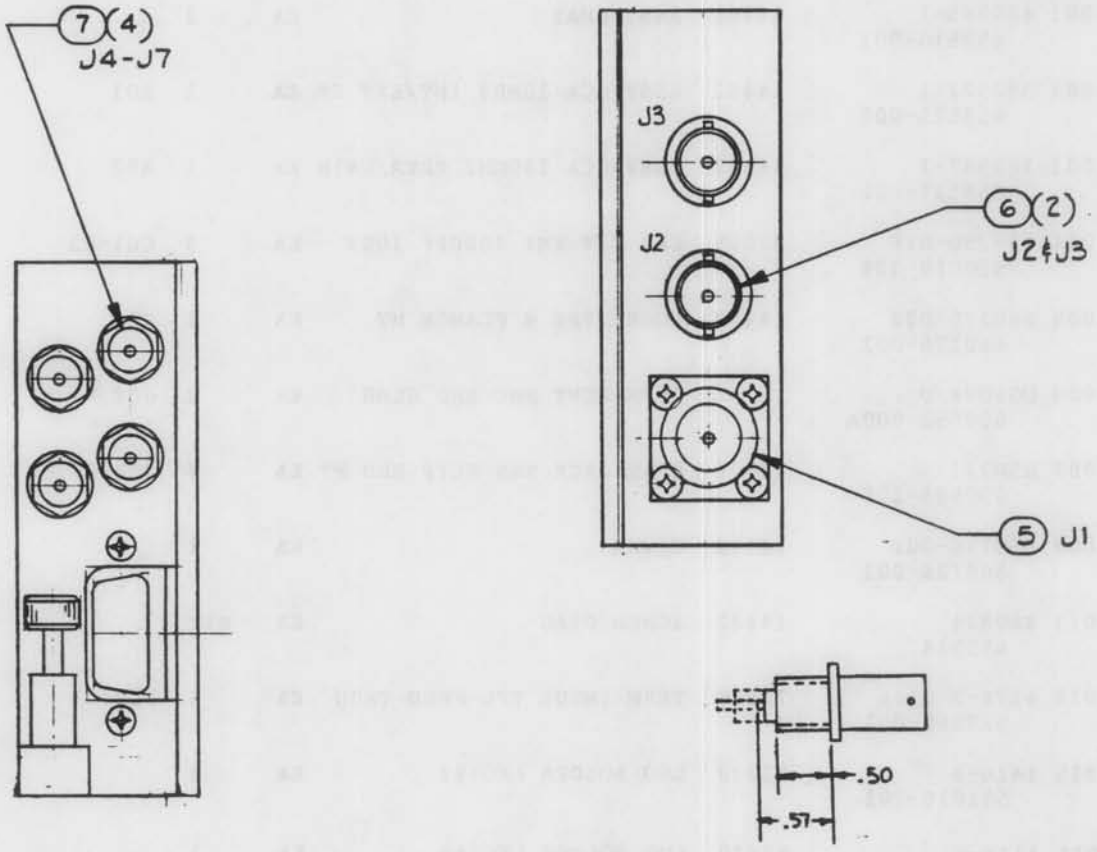


FIG. 1

659513A/2

5 REMOVE APPROX. .25 IN. OFF EACH SIDE OF OSC. LABEL SO GROUNDING SPRINGS MAKE CONTACT WITH OSC. CASE.

4 TRIM J2 DIELECTRIC & CENTER CONDUCTOR SO AS NOT TO SHORT OUT TO HOUSING. SEE FIG 1 FOR APPROX DIM.

3 SOLDER JACKET TO A2 GND PLANE AND LUG AT J1 AND CENTER CONDUCTOR TO A2E1 AND J1 CENTER CONDUCTOR.

2. REFERENCE DESIGNATIONS ARE FOR REFERENCE ONLY AND MAY OR MAY NOT APPEAR ON PART

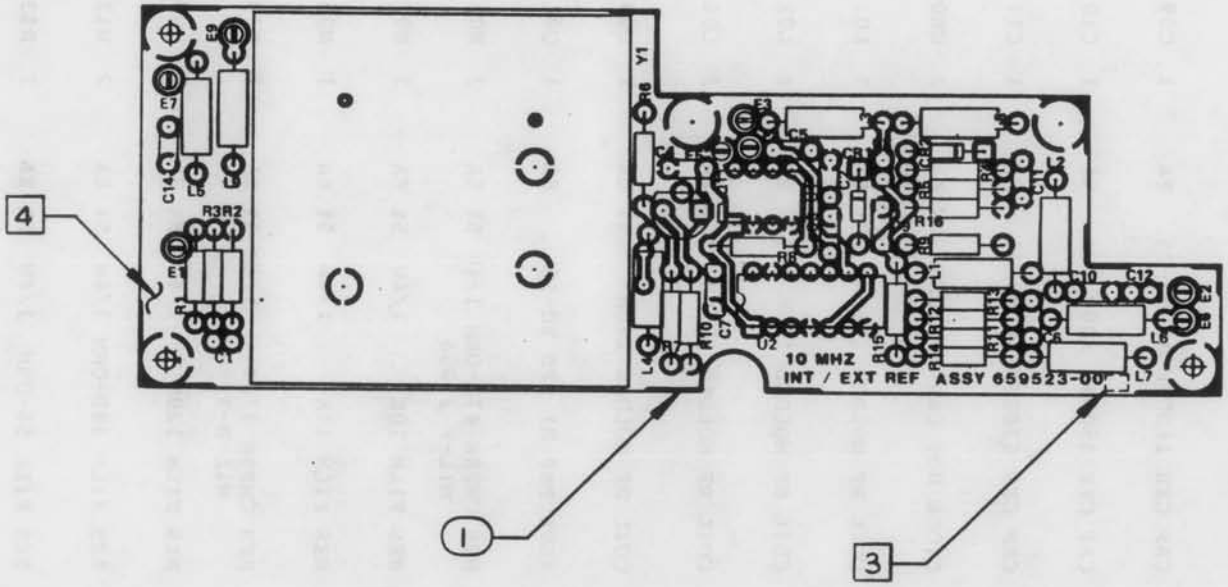
1. SOLDER PER MIL-STD-454 REQUIREMENTS

NOTES: UNLESS OTHERWISE SPECIFIED

Figure 5-10. 10 MHz Reference Generator/MUX A9 Parts List, Part No. 659513 (Sheet 2 of 3)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
001	480845-1 659516-001	14482	ASSY-CHAS	EA	1	
002	380922-1 659523-001	14482	ASSY-CCA 10MHZ INT/EXT RF	EA	1	A01
003	380987-1 659527-001	14482	ASSY-CCA 160MHZ FLTR/GAIN	EA	1	A02
004	54-790-018 990018-324	33095	CAP F/T EMI 1000PF 100V	EA	3	C01-03
005	660175-002 660175-002	14482	CONN TYPE N FLANGE MT	EA	1	J01
006	UG1094/U 090552-000A		CONN RCPT BNC BHD SLDR	EA	2	J02 03
007	OSM211 090999-175	16179	CONN JACK SMA RCTP BHD FT	EA	4	J04-07
009	660726-001 660726-001	14482	COVER	EA	1	
013	480824 659514	14482	SCHEM DIAG	EA	REF	
014	4176-2-0516 529060-001	71279	TERM INSUL TFL FEED-THRU	EA	1	FL01
015	1416-4 511010-201	83330	LUG SOLDER LKG #4	EA	3	
016	1416-6 511010-301	83330	LUG SOLDER LKG #6	EA	1	
017	WL659513 WL659513		WIRE LIST	EA	REF	
018	RG188A/U 450010-004		CABLE COAX MIL-C-17/69	FT	AR	
019	DA50047 990018-856	64639	CABLE SEMI-RIGID	FT	AR	
020	659705-001 659705-001	14482	BRKT GROUNDING	EA	1	
			EXPLOSION FINISHED			

Figure 5-10. 10 MHz Reference Generator/MUX A9 Parts List, Part No. 659513 (Sheet 3 of 3)



4 ASSY SIDE SHOWN AS NEGATIVE FOR CLARITY ONLY.

3 MARK DASH NUMBER PER MIL-STD-130 APPROXIMATELY WHERE SHOWN USING .12 HIGH CHARACTERS WITH WHITE INK COLOR NO 17875 PER FED-STD-595.

2. OBSERVE POLARITY OF CAPACITORS AND SEMICONDUCTOR DEVICES.

1. SOLDER PER MIL-STD-454

NOTES: UNLESS OTHERWISE SPECIFIED

659523A

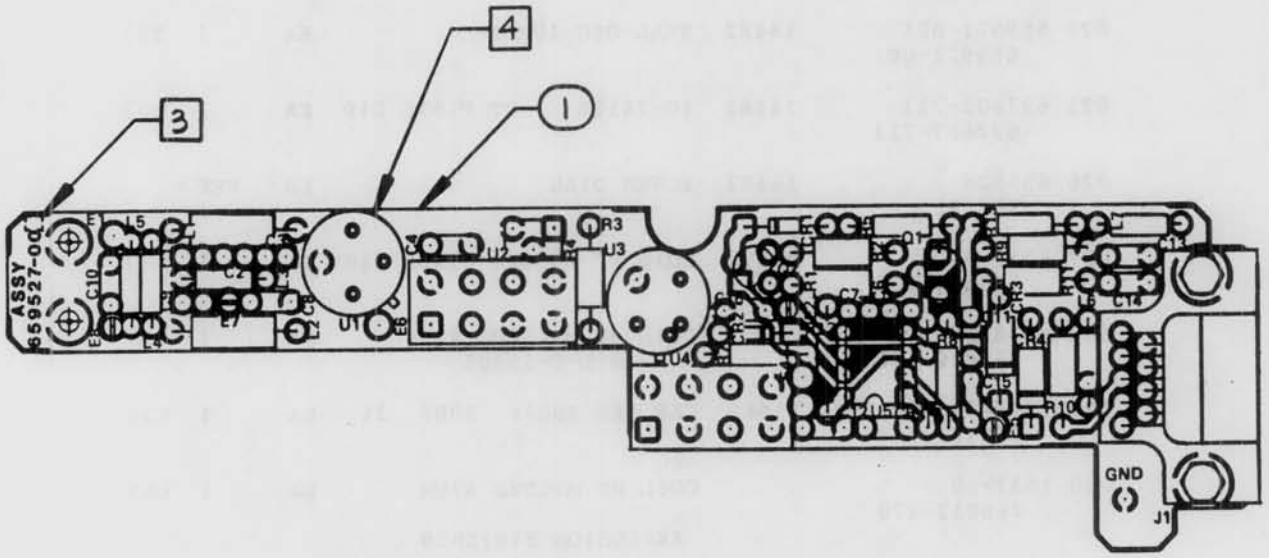
Figure 5-11. 10 MHz Internal/External RF CCA A9A1 Parts List, Part No. 659523 (Sheet 1 of 3)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
001	659524-001 659524-001	14482	PWB	EA	1	
002	150-100-NP0-331G 759162-330	51642	CAP CER 330PF 100V 2%	EA	1	C01
003	660073-104 660073-104	14482	CAP CER .1UF 50V 20%	EA	7	C02-07 14
004	150-100-NP0-330G 759161-330	51642	CAP CER 33PF 100V 2%	EA	1	C08
005	200-100-NP0-162G 759163-160	51642	CAP CER 1600PF 100V 2%	EA	1	C09
006	300-100-NP0-392G 759163-390	51642	CAP CER 3900PF 100V 2%	EA	1	C10
007	300-100-NP0-622G 759163-620	51642	CAP CER 6200PF 100V 2%	EA	1	C11
008	5082-2800 775000-002	28480	DIODE HOT CARRER .25W 70V	EA	2	CR01 02
009	1537-00 760050-150	99800	COIL RF MOLDED .15UH 20%	EA	1	L01
010	1537-40 760012-150	99800	COIL RF MOLDED 15UH 10%	EA	2	L02 08
011	1537-24 760051-330	99800	COIL RF MOLDED 3.3UH 10%	EA	2	L06 09
012	1537-48 760052-270	99800	COIL RF MOLDED 27UH 5%	EA	1	L04
013	2N4403 780000-023	80131	XSTR PNP HI SPD TO-92	EA	1	Q01
014	RCR07G471JS 740072-470		RES CMPSN 470-OHM 1/4W 5% MIL-R-39008	EA	3	R01 07 10
015	CF1/4-10K/J 744074-100	09021	RES FILM 10K 1/4W 5%	EA	3	R02 04 05
016	CF1/4-11K/J 744074-110	09021	RES FILM 11K 1/4W 5%	EA	1	R03
018	RCR07G474JS 740075-470		RES CMPSN 470K 1/4W 5% MIL-R-39008	EA	1	R08
019	CF1/4-120K/J 744075-120	09021	RES FILM 120K 1/4W 5%	EA	1	R09
020	CF1/4-390-OHMS/J 744072-390	09021	RES FILM 390-OHM 1/4W 5%	EA	2	R12 15
021	CF1/4-56-OHMS/J 744071-560	09021	RES FILM 56-OHM 1/4W 5%	EA	2	R13 16
022	CF1/4-1K/J 744073-100	09021	RES FILM 1K 1/4W 5%	EA	3	R06 11 14

Figure 5-11. 10 MHz Internal/External RF CCA A9A1 Parts List, Part No. 659523 (Sheet 2 of 3)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
023	627607-795 627607-795	14482	IC-75140 CT PLSTC DIP	EA	1	U01
024	659971-001 659971-001	14482	XTAL OSC 10MHZ	EA	1	Y01
025	627607-711 627607-711	14482	IC-74125 CT PLSTC DIP	EA	1	U02
026	659526 659526	14482	SCHEM DIAG	EA	REF	
027	1537-34 760051-820	99800	COIL RF MOLDED 8.2UH 10%	EA	1	L03
028	MS18130-6 760010-680		COIL RF MOLDED .68UH MIL-C-15305	EA	1	L07
029	150-100-NP0-301G 759162-300	51642	CAP CER 300PF 100V 2%	EA	1	C12
030	1537-60 760012-470		COIL RF MOLDED 47UH	EA	1	L05
			EXPLOSION FINISHED			

Figure 5-11. 10 MHz Internal/External RF CCA A9A1 Parts List, Part No. 659523 (Sheet 3 of 3)



659527B

4 SOLDER CASE OF U1 & U3 TO GND PLANE.

3 MARK DASH NUMBER PER MIL-STD-130 APPROXIMATELY WHERE SHOWN USING .12 HIGH CHARACTERS WITH WHITE INK COLOR NO 17875 PER FED-STD-595

2. OBSERVE POLARITY OF CAPACITORS AND SEMICONDUCTOR DEVICES

1. SOLDER PER MIL-STD-454

NOTES: UNLESS OTHERWISE SPECIFIED

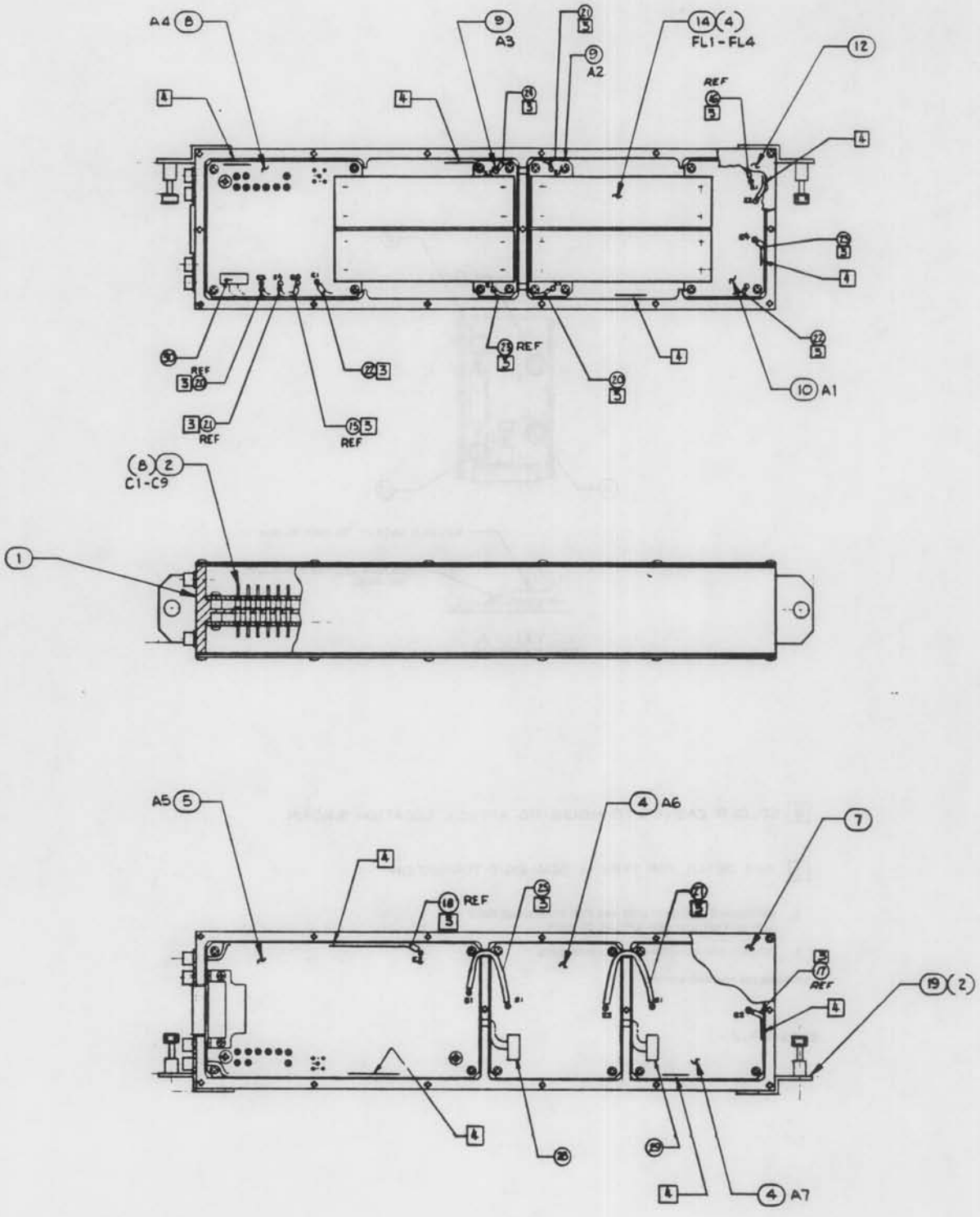
Figure 5-12. 160 MHz Filter/Gain Control CCA A9A2 Parts List, Part No. 659527 (Sheet 1 of 3)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
			REV. B			
001	659528-001 659528-001	14482	PWB	EA	1	
002	200-100-NP0-680G 759161-680	51642	CAP CER 68PF 100V 2%	EA	2	C01 03
003	100-100-NP0-220G 759161-220	51642	CAP CER 22PF 100V 2%	EA	1	C02
004	660073-474 660073-474	14482	CAP CER .47UF 50V 20%	EA	1	C04
005	660073-103 660073-103	14482	CAP CER .01UF 50V 20%	EA	1	C05
006	150-100-NP0-221G 759162-220	51642	CAP CER 220PF 100V 2%	EA	2	C06 07
007	200-100-NP0-162G 759163-160	51642	CAP CER 1600PF 100V 2%	EA	1	C08
008	200-100-NP0-750G 759161-750	51642	CAP CER 75PF 100V 2%	EA	1	C09
009	200-100-NP0-272G 759163-270	51642	CAP CER 2700PF 100V 2%	EA	1	C10
010	1N4449 775000-001	80131	DIO HI COND HS SW 75PPV	EA	2	CR01 02
011	1N753A 771000-007B		DIO ZR 6.2V .4W 5% DO7	EA	1	CR03
012	1N751A 771000-005B		DIO ZR 5.1V .4W 5% DO7	EA	1	CR04
013	56-704-005 990018-253	33095	CONN RCPT EMI 9POS FEM D	EA	1	J01
014	L10-0R068 990018-254	7W259	INDUCTOR .068UH 2000MA 1%	EA	2	L01 02
015	1025-00 760040-150	99800	COIL FIXED MOLD .15UH 10%	EA	1	L03
016	1025-32 760041-330	99800	COIL FIXED MOLD 3.3UH 10%	EA	2	L04 05
017	2N4403 780000-023	80131	XSTR PNP HI SPD TO-92	EA	1	Q01
018	U1899E 780000-024	15818	XSTR JFET SW	EA	1	Q02
019	RN55C2000F 741552-200		RES FILM 200-OHM 1/10W 1% MIL-R-10509	EA	2	R01 02
020	RN55C9090F 741552-909		RES FILM 909-OHM 1/10W 1% MIL-R-10509	EA	1	R03
021	3260W-1-202 990018-912	32997	RES VAR WW SCR ADJ 2K	EA	1	R04

Figure 5-12. 160 MHz Filter/Gain Control CCA A9A2 Parts List, Part No. 659527 (Sheet 2 of 3)

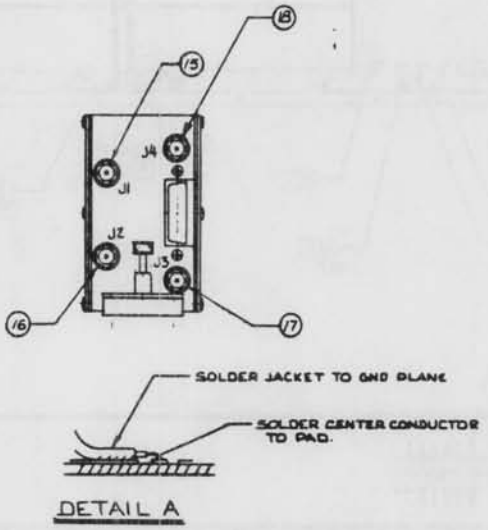
ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
022	CF1/4-1K/J 744073-100	09021	RES FILM 1K 1/4W 5%	EA	1	R05
023	CF1/4-4.7K/J 744073-470	09021	RES FILM 4.7K 1/4W 5%	EA	1	R06
024	CF1/4-100K/J 744075-100	09021	RES FILM 100K 1/4W 5%	EA	1	R07
025	CF1/4-10K/J 744074-100	09021	RES FILM 10K 1/4W 5%	EA	1	R08
026	RN55C8251F 741553-825		RES FILM 8.25K 1/10W 1% MIL-R-10509	EA	1	R09
027	RN55C2743F 741555-274		RES FILM 274K 1/10W 1% MIL-R-10509	EA	1	R10
028	RN55C2742F 741554-274		RES FILM 27.4K 1/10W 1% MIL-R-10509	EA	1	R11
029	WJPA-2 990009-262	14482	AMPL CASC 10-300MHZ TO-8	EA	1	U01
030	PDC-10-1 990018-639	15542	CPLR DIR	EA	1	U02
031	WJG1 990009-259	14482	IC-VOLT CONT ATTEN	EA	1	U03
032	PSC-2-1W 990018-636	15542	PWR DIVIDER 1-650MHZ 2WAY	EA	1	U04
033	627601-063 627601-063	14482	IC-1458 CT PLSTC DIP	EA	1	U05
039	659530 659530	14482	SCHEM DIAG	EA	REF	
040	660073-104 660073-104	14482	CAP CER .1UF 50V 20%	EA	5	C11-15
041	1025-60 760042-470	99800	COIL FIXED MOLD 47UH 10%	EA	2	L06 07
042	CF1/4-10-OHMS/J 744071-100	09021	RES FILM 10-OHM 1/4W 5%	EA	2	R12 13
043	CK05BX222K 750153-220		CAP CER 2200PF 100V 10% MIL-C-11015 EXPLOSION FINISHED	EA	1	C16

Figure 5-12. 160 MHz Filter/Gain Control CCA A9A2 Parts List, Part No. 659527 (Sheet 3 of 3)



659548A/1

Figure 5-13. 160 MHz Filter/IF Gain CCA A10 Parts List, Part No. 659548 (Sheet 1 of 4)



4 SOLDER CABLES TO HOUSING APPROX. LOCATION SHOWN.

3 SEE DETAIL FOR TYPICAL SEMI-RIGID TERMINATION.

2. REFERENCE DESIGNATIONS ARE FOR REFERENCE ONLY AND MAY OR MAY NOT APPEAR ON PART

1. SOLDER PER MIL-STD-454 REQUIREMENTS

NOTES: UNLESS OTHERWISE SPECIFIED

659548A/2

Figure 5-13. 160 MHz Filter/IF Gain CCA A10 Parts List, Part No. 659548 (Sheet 2 of 4)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS	REV. A
001	660102-001 660102-001	14482	HOUSING FLTR GAIN MODULE	EA	1		
002	859615-1 990018-323	00779	CAP FEED THRU	EA	9	C01-08	
004	659540-001 659540-001	14482	ASSY-CCA AGC1/AGC2	EA	2	A06 07	
005	659544-001 659544-001	14482	ASSY-CCA IF ROOFING FLTR	EA	1	A05	
007	660104-001 660104-001	14482	COVER RIGHT	EA	1		
008	660038-001 660038-001	14482	ASSY-CCA OUTPUT SW	EA	1	A04	
009	660030-001 660030-001	14482	ASSY-CCA 160MHZ FLTR BD	EA	2	A02 03	
010	660034-001 660034-001	14482	ASSY-CCA 160 INPUT SW BD	EA	1	A01	
012	660103-001 660103-001	14482	COVER LEFT	EA	1		
014	658149-0XX 658149-0XX	14482	FLTR 160MHZ FACTORY SEL	EA	AR	FL01-04	SEE NOTE 1
015	660724-001 660724-001	14482	ASSY-CABLE	EA	1		
016	660724-002 660724-002	14482	ASSY-CABLE	EA	1		
017	660724-003 660724-003	14482	ASSY-CABLE	EA	1		
018	660724-004 660724-004	14482	ASSY-CABLE	EA	1		
019	660105-001 660105-001	14482	BRKT MTG	EA	2		
020	660724-005 660724-005	14482	ASSY-CABLE	EA	1		
021	660724-006 660724-006	14482	ASSY-CABLE	EA	1		
022	660724-007 660724-007	14482	ASSY-CABLE	EA	1		
023	660724-008 660724-008	14482	ASSY-CABLE	EA	1		
024	660724-009 660724-009	14482	ASSY-CABLE	EA	1		
025	660724-010 660724-010	14482	ASSY-CABLE	EA	1		

Figure 5-13. 160 MHz Filter/IF Gain CCA A10 Parts List, Part No. 659548 (Sheet 3 of 4)

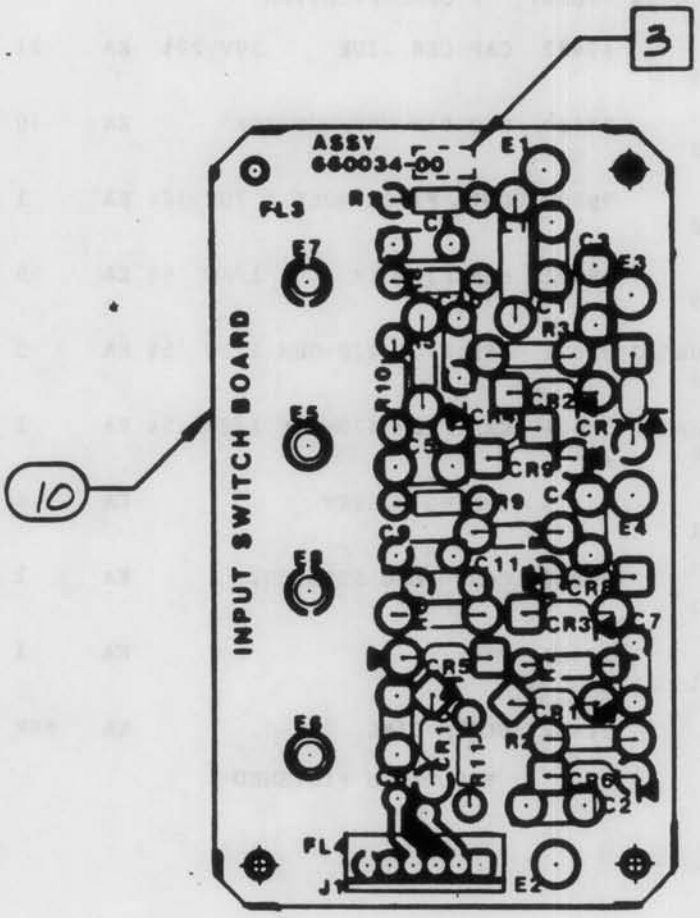
ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
026	660101 660101	14482	SCHEM DIAG	EA	REF	
027	660724-011 660724-011	14482	ASSY-CABLE	EA	1	
028	660179-010 660179-010	14482	ASSY-CABLE	EA	1	
029	660179-011 660179-011	14482	ASSY-CABLE	EA	1	
030	660179-012 660179-012	14482	ASSY-CABLE	EA	1	

EXPLOSION FINISHED

NOTES: UNLESS OTHERWISE SPECIFIED

1: CUSTOMER OPTION.

Figure 5-13. 160 MHz Filter/IF Gain CCA A10 Parts List, Part No. 659548 (Sheet 4 of 4)



660034A

3 MARK DASH NUMBER PER MIL-STD 130 APPROXIMATELY WHERE SHOWN USING .12 HIGH CHARACTERS WITH **WHITE** INK COLOR NO **17875** PER FED-STD-595.

2. OBSERVE POLARITY OF CAPACITORS AND SEMICONDUCTOR DEVICES

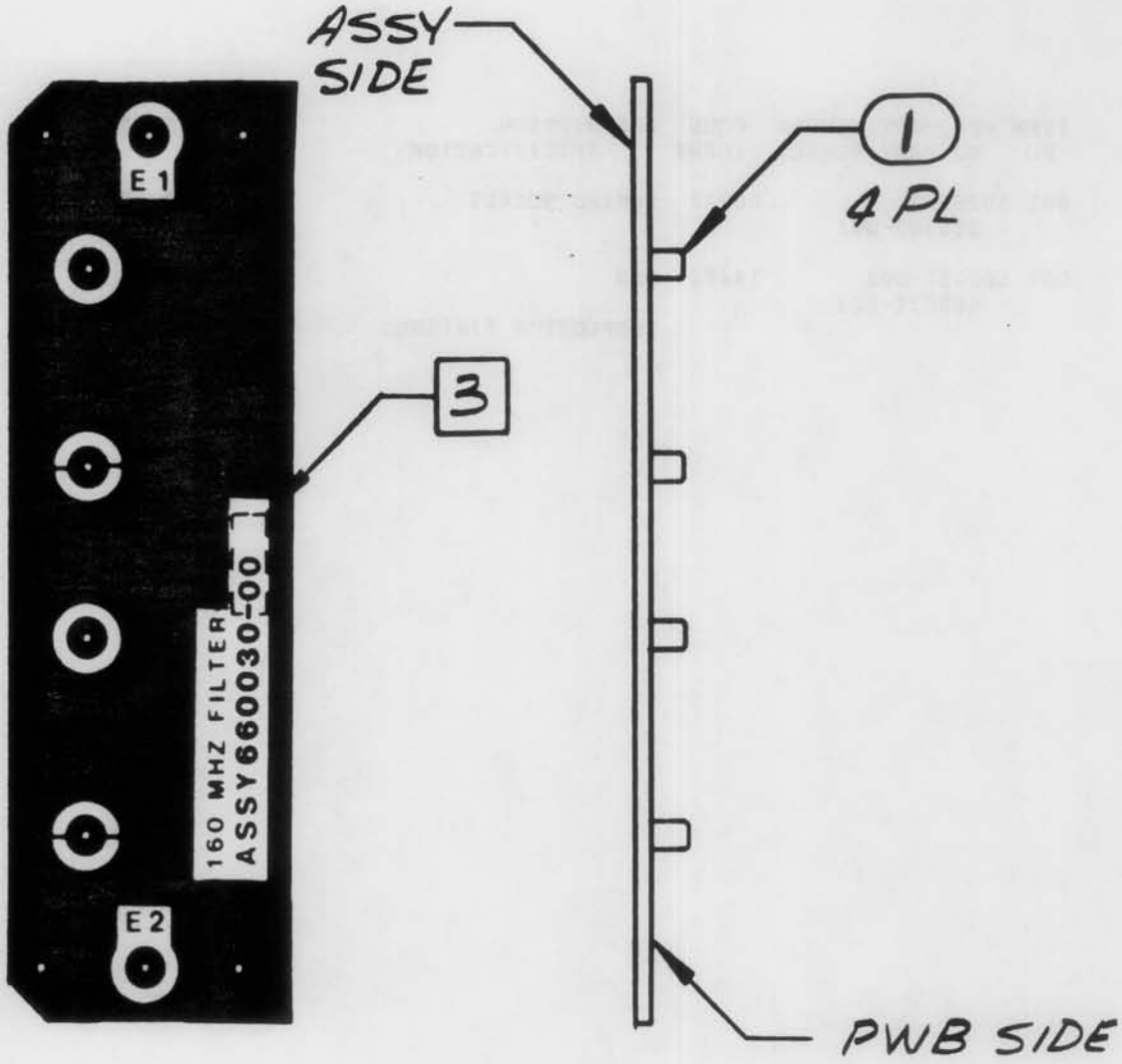
1. SOLDER PER MIL-STD-454

NOTES: UNLESS OTHERWISE SPECIFIED

Figure 5-14. 160 MHz Input Switch CCA A10A1 Parts List, Part No. 660034 (Sheet 1 of 2)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
001	660073-104 660073-104	14482	CAP CER .1UF 50V 20%	EA	11	C01-11
002	5082-3188 990018-292	28480	DIO PIN VHF/UHF 1PF	EA	10	CR01-10
003	1025-36 760041-470	99800	COIL FIXED MOLD 4.7UH 10%	EA	1	L01
004	CF1/8-1K/J 744053-100	09021	RES FILM 1K 1/8W 5%	EA	5	R02-06
005	CF1/8-220-OHMS/J 744052-220	09021	RES FILM 220-OHM 1/8W 5%	EA	5	R07-11
006	CF1/8-470-OHMS/J 744052-470	09021	RES FILM 470-OHM 1/8W 5%	EA	1	R01
007	50865-3 588300-001	00779	SPRING SOCKET	EA	4	E05-08
008	10-32-1063 799100-013	27264	CONN PLUG STRAIGHT	EA	1	J01
010	660035-001 660035-001	14482	PWB	EA	1	
011	660037 660037	14482	SCHEM DIAG	EA	REF	
			EXPLOSION FINISHED			

Figure 5-14. 160 MHz Input Switch CCA A10A1 Parts List, Part No. 660034 (Sheet 2 of 2)



660030A

3 MARK DASH NUMBER PER MIL STD 130 APPROXIMATELY WHERE SHOWN USING .12 HIGH CHARACTERS WITH BLACK INK COLOR NO 17038 PER FED-STD-595

2. OBSERVE POLARITY OF CAPACITORS AND SEMICONDUCTOR DEVICES

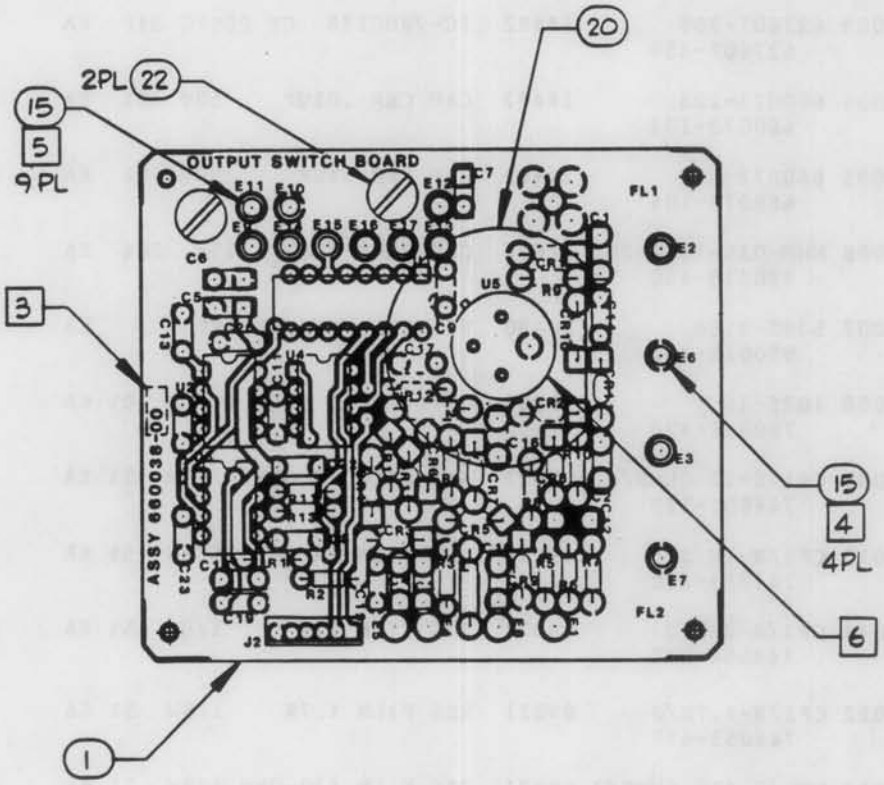
1. SOLDER PER MIL-STD-454

NOTES: UNLESS OTHERWISE SPECIFIED

Figure 5-15. 160 MHz Filter CCA A10A2 and A3 Parts List, Part No. 660030 (Sheet 1 of 2)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
001	50865-3 588300-001	00779	SPRING SOCKET	EA	4	E01-04
004	660031-001 660031-001	14482	PWB	EA	1	
			EXPLOSION FINISHED			

Figure 5-15. 160 MHz Filter CCA A10A2 and A3 Parts List, Part No. 660030 (Sheet 2 of 2)



6 SOLDER CASE OF U5 TO GND PLANE.

5 MOUNT SOCKETS FOR E9-E17 FROM PWB SIDE.

4 MOUNT SOCKETS FOR E2, E3, E6 & E7 FROM ASSY SIDE.

3 MARK DASH NUMBER PER MIL-STD-130 APPROXIMATELY WHERE SHOWN USING .12 HIGH CHARACTERS WITH WHITE INK COLOR NO 17875 PER FED-STD-595

2. OBSERVE POLARITY OF CAPACITORS AND SEMICONDUCTOR DEVICES.

1. SOLDER PER MIL-STD-454

NOTES: UNLESS OTHERWISE SPECIFIED

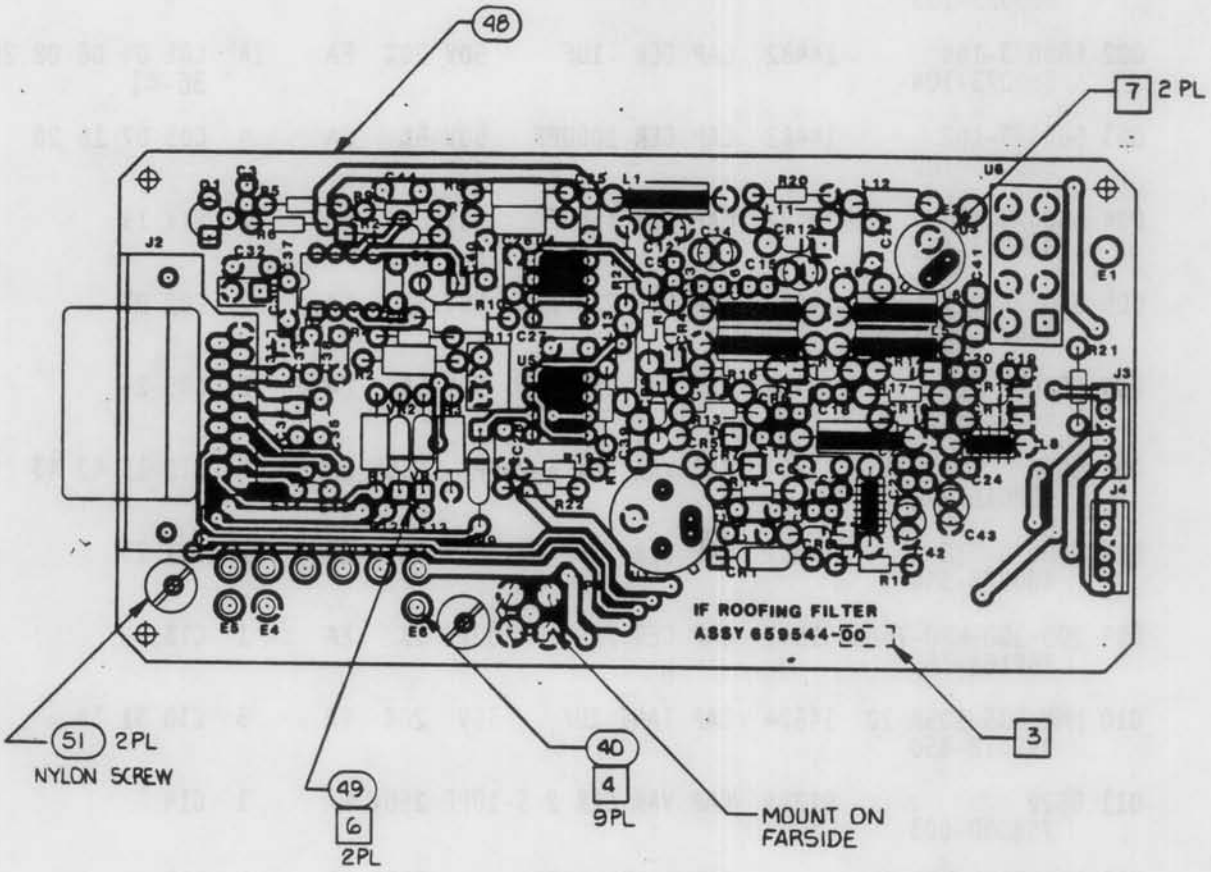
660038A

Figure 5-16. 160 MHz Output Switch CCA A10A4 Parts List, Part No. 660038 (Sheet 1 of 2)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS (REV. B)
001	660039-001 660039-001	14482	PWB	EA	1	
002	660041 660041	14482	SCHEM DIAG	EA	REF	
003	627607-359 627607-359	14482	IC-74HC138 CT PLSTC DIP	EA	1	U01
004	660073-103 660073-103	14482	CAP CER .01UF 50V 20%	EA	4	C20-23
005	660073-104 660073-104	14482	CAP CER .1UF 50V 20%	EA	16	C01-04 08-19
006	MMM-035-105R-20 990018-450	14674	CAP TANT 1UF 35V 20%	EA	3	C05-07
007	5082-3188 990018-292	28480	DIO PIN VHF/UHF 1PF	EA	13	CR01-13
008	1025-36 760041-470	99800	COIL FIXED MOLD 4.7UH 10%	EA	2	L01 02
009	CF1/8-12-OHMS/J 744051-120	09021	RES FILM 12-OHM 1/8W 5%	EA	1	R06
010	CF1/8-1K/J 744053-100	09021	RES FILM 1K 1/8W 5%	EA	6	R04 08-11 13
011	CF1/8-22K/J 744054-220	09021	RES FILM 22K 1/8W 5%	EA	1	R01
012	CF1/8-4.7K/J 744053-470	09021	RES FILM 4.7K 1/8W 5%	EA	1	R02
013	CF1/8-430-OHMS/J 744052-430	09021	RES FILM 430-OHM 1/8W 5%	EA	2	R05 07
014	CF1/8-470-OHMS/J 744052-470	09021	RES FILM 470-OHM 1/8W 5%	EA	2	R03 12
015	50865-3 588300-001	00779	SPRING SOCKET	EA	13	E02 03 06 07 09-17
016	QBH-302 990018-635	55027	AMPL 10-450MHZ TO-8/4	EA	1	U05
017	627601-063 627601-063	14482	IC-1458 CT PLSTC DIP	EA	3	U02-04
018	10-31-1063 799100-015	27264	CONN PLUG STRAIGHT	EA	1	J02
019	52-052-0000 990018-353	98291	CONN RCTP PLUG STR PC MT	EA	1	J01
020	660730-001 660730-001	14482	HEATSINK	EA	1	REF U05
022	2504 990018-930	83330	NYLON SCREW 6-32 X .375	EA	2	

EXPLOSION FINISHED

Figure 5-16. 160 MHz Output Switch CCA A10A4 Parts List, Part No. 660038 (Sheet 2 of 2)



659544B

7 SOLDER CASE OF U1 + U3 TO GND PLANE.

6 INSTALL ITEM 49 BETWEEN E12 AND E13, E14 AND E15.

5 ASSEMBLY SIDE GROUND PLANE NOT SHOWN.

4 MOUNT ITEM 40 FROM PWB SIDE, E3-E11.

3 MARK DASH NUMBER PER MIL-STD-130 APPROXIMATELY WHERE SHOWN USING .12 HIGH CHARACTERS WITH BLACK INK COLOR NO 17038 PER FED-STD-595.

2. OBSERVE POLARITY OF CAPACITORS AND SEMICONDUCTOR DEVICES.

1. SOLDER PER MIL-STD-454

NOTES: UNLESS OTHERWISE SPECIFIED

Figure 5-17. IF Roofing Filter CCA A10A5 Parts List, Part No. 659544 (Sheet 1 of 4)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS	REV. C
001	660073-103 660073-103	14482	CAP CER .01UF 50V 20%	EA	4	C29 32 33 35	
002	660073-104 660073-104	14482	CAP CER .1UF 50V 20%	EA	14	C01 04 06 08 25-28 36-41	
003	660073-102 660073-102	14482	CAP CER 1000PF 50V 5%	EA	4	C05 07 16 20	
004	660073-151 660073-151	14482	CAP CER 150PF 50V 5%	EA	2	C17 19	
005	660073-221 660073-221	14482	CAP CER 220PF 50V 5%	EA	2	C02 03	
006	660073-220 660073-220	14482	CAP CER 22PF 50V 5%	EA	2	C09 24	
007	9626 990018-440	91293	CAP VAR CER 6-25PF 250V	EA	4	C12 15 42 43	
008	660073-330 660073-330	14482	CAP CER 33PF 50V 5%	EA	2	C21 23	
009	200-100-NP0-7506 759161-750	51642	CAP CER 75PF 100V 2%	EA	1	C18	
010	MMM-035-105R-20 990018-450	14674	CAP TANT 1UF 35V 20%	EA	3	C30 31 34	
011	9622 758000-003	91293	CAP VAR CER 2.5-10PF 250V	EA	1	C14	
012	RD0870-1-NP0-2R4 759090-240		CAP 2.4PF *C504 .25PF	EA	1	C22	
013	R0870-1-NP0-4R7* 759090-470		CAP 4.7PF *C504 .25PF	EA	1	C13	
014	660060-003 660060-003	14482	CHOKE 13 TURNS T-30-6	EA	2	L07 08	
015	56-714-005 990018-317	33095	CONN PC MT 15POS	EA	1	J02	
016	1N4449 775000-001	80131	DIO HI COND HS SW 75PPV	EA	3	CR01 02 09	
017	5082-3188 990018-292	28480	DIO PIN VHF/UHF 1PF	EA	12	CR03-08 11-16	
018	L10-0R040 760040-040	7W259	COIL FXD .040UH 1%	EA	2	L01 03	
019	L10-0R121 760040-121	7W259	COIL FXD .121UH 1%	EA	1	L02	

Figure 5-17. IF Roofing Filter CCA A10A5 Parts List, Part No. 659544 (Sheet 2 of 4)

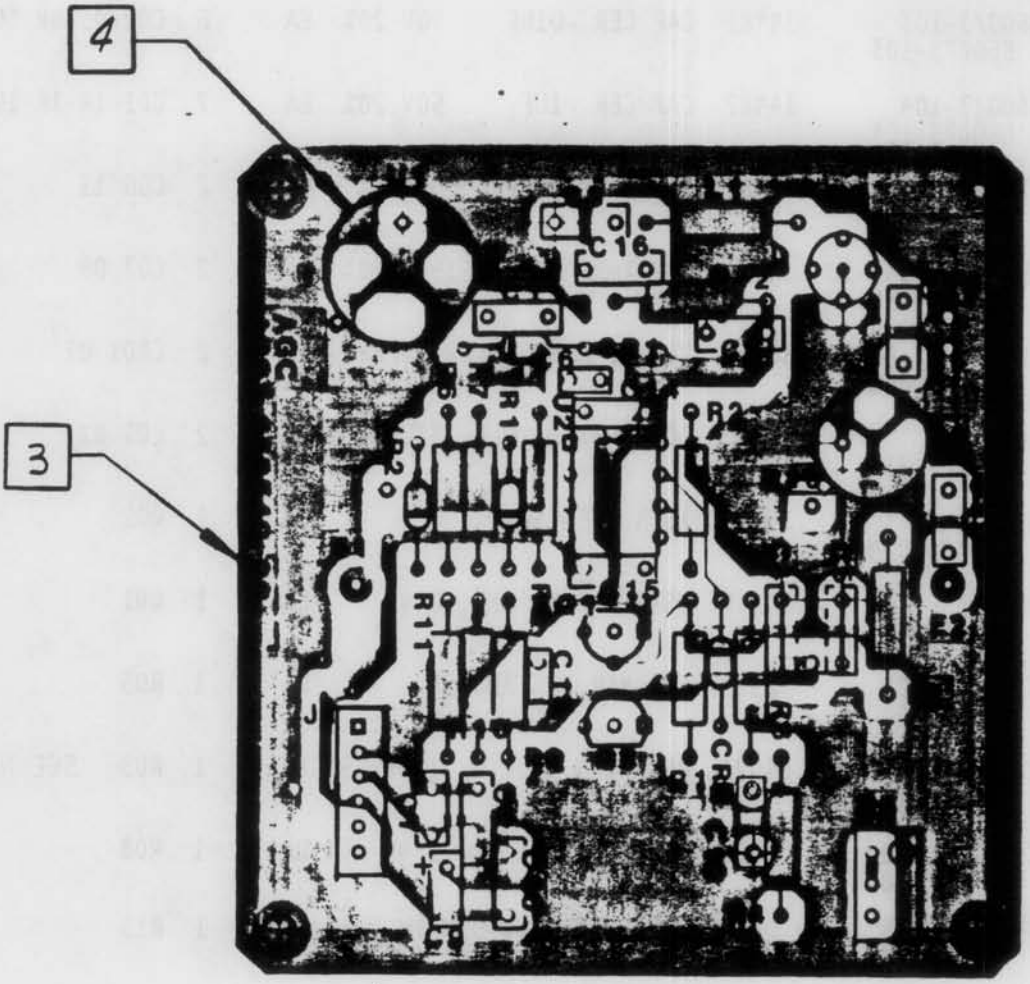
ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
020	L10-0R383 760040-383	7W259	COIL FXD .383UH	1% EA	2	L04 06
021	L10-0R828 990018-722	7W259	COIL FXD .828UH	1% EA	1	L05
022	1025-36 760041-470	99800	COIL FIXED MOLD 4.7UH	10% EA	2	L11 13
023	U1899E 780000-024	15818	XSTR JFET SW	EA	1	Q02
024	2N4403 780000-023	80131	XSTR PNP HI SPD TO-92	EA	1	Q01
025	RJ24FW202 990009-556		RES VAR SCR ADJ 2K MIL-R-22097	EA	1	R11
026	CF1/4-100K/J 744075-100	09021	RES FILM 100K 1/4W	5% EA	1	R22
027	CF1/4-10K/J 744074-100	09021	RES FILM 10K 1/4W	5% EA	1	R04
028	CF1/4-1K/J 744073-100	09021	RES FILM 1K 1/4W	5% EA	7	R06 12-14 16-18
029	RN55C2000F 741552-200		RES FILM 200-OHM 1/10W MIL-R-10509	1% EA	2	R07 08
030	CF1/4-22K/J 744074-220	09021	RES FILM 22K 1/4W	5% EA	1	R15
031	RN55C2742F 741554-274		RES FILM 27.4K 1/10W MIL-R-10509	1% EA	1	R02
032	RN55C2743F 741555-274		RES FILM 274K 1/10W MIL-R-10509	1% EA	1	R01
033	CF1/4-4.7K/J 744073-470	09021	RES FILM 4.7K 1/4W	5% EA	2	R05 19
034	CF1/4-470-OHMS/J 744072-470	09021	RES FILM 470-OHM 1/4W	5% EA	2	R20 23
035	CF1/4-8.2-OHMS/J 744070-820	09021	RES FILM 8.2-OHM 1/4W	5% EA	1	R21
036	RN55C8251F 741553-825		RES FILM 8.25K 1/10W MIL-R-10509	1% EA	1	R03 SEE NOTE 1
037	RN55C9090F 741552-909		RES FILM 909-OHM 1/10W MIL-R-10509	1% EA	1	R10

Figure 5-17. IF Roofing Filter CCA A10A5 Parts List, Part No. 659544 (Sheet 3 of 4)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
038	JAN1N751A 771000-005		DIO ZR 5.1V .4W 5% A298 MIL-S-19500	EA	1	VR02
039	JAN1N753A 771000-007		DIO ZR 6.2V .4W 5% A298 MIL-S-19500	EA	1	VR01
040	50865-3 588300-001	00779	SPRING SOCKET	EA	9	E03-11
041	WJ61 990009-259	14482	IC-VOLT CONT ATTEN	EA	1	U01
042	627602-028 627602-028	14482	IC-230 CT MET CAN	EA	1	U03
043	627603-326 627603-326	14482	IC-34002 CT PLSTC DIP	EA	1	U02
044	627601-063 627601-063	14482	IC-1458 CT PLSTC DIP	EA	2	U04 05
045	PSC-2-1W 990018-636	15542	PWR DIVIDER 1-650MHZ 2WAY	EA	1	U06
046	10-32-1063 799100-013	27264	CONN PLUG STRAIGHT	EA	2	J03 04
047	52-051-0000 990018-208	98291	CONN RCTP JACK STR PC MT	EA	1	P01
048	659545-001 659545-001	14482	PWB	EA	1	
049	20AWG-QQW343 442202-000		WIRE BUS SOLID TINNED CU QQ-W-343	FT	AR	W01 02
050	659547 659547	14482	SCHEM DIAG	EA	REF	
051	2504 990018-930	83330	NYLON SCREW 6-32 X .375	EA	2	
052	200-100-NP0-2226 759163-220	51642	CAP CER 2200PF 100V 2%	EA	1	C44
052	1025-08 760040-330	99800	COIL FIXED MOLD .33UH 10%	EA	1	L12
053	CF1/4-100K/J 744075-100*	09021	RES FILM 100K 1/4W 5%	EA	1	R09 SEE NOTE 1

EXPLOSION FINISHED

Figure 5-17. IF Roofing Filter CCA A10A5 Parts List, Part No. 659544 (Sheet 4 of 4)



659540B

4 SOLDER CASE OF U1 & U4 TO GROUND PLANE

3 MARK DASH NUMBER PER MIL-STD-130 APPROXIMATELY WHERE SHOWN USING .12 HIGH CHARACTERS WITH WHITE INK COLOR NO 17875 PER FED-STD-595.

2. OBSERVE POLARITY OF CAPACITORS AND SEMICONDUCTOR DEVICES

1. SOLDER PER MIL-STD-454

NOTES: UNLESS OTHERWISE SPECIFIED

Figure 5-18. AGC CCA A10A6 and A7 Parts List, Part No. 659540 (Sheet 1 of 3)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS	REV. C
001	660073-103 / 660073-103	14482	CAP CER .01UF 50V 20%	EA	6	C02-05 08 10	
002	660073-104 / 660073-104	14482	CAP CER .1UF 50V 20%	EA	7	C01 14-18 19	
003	660073-221 / 660073-221	14482	CAP CER 220PF 50V 5%	EA	2	C06 13	
004	MMM-035-105R-20 / 990018-450	14674	CAP TANT 1UF 35V 20%	EA	2	C07 09	
005	1N4449 / 775000-001	80131	DIO HI COND HS SW 75PPV	EA	2	CR01 02	
006	1025-08 / 760040-330	99800	COIL FIXED MOLD .33UH 10%	EA	2	L01 02	
007	U1899E / 780000-024	15818	XSTR JFET SW	EA	1	Q02	
008	2N4403 / 780000-023	80131	XSTR PNP HI SPD TO-92	EA	1	Q01	
009	3282W-1-202 / 070951-000	32997	RES VAR SCR ADJ 2K	EA	1	R05	
010	CF1/4-100K/J / 744075-100	09021	RES FILM 100K 1/4W 5%	EA	1	R03	SEE NOTE 1
011	CF1/4-10K/J / 744074-100	09021	RES FILM 10K 1/4W 5%	EA	1	R08	
012	RCR326101JS / 740322-100		RES CMPSN 100-OHM 1W 5% MIL-R-39008	EA	1	R13	
013	CF1/4-1K/J / 744073-100	09021	RES FILM 1K 1/4W 5%	EA	1	R10	
014	RN55C2000F / 741552-200		RES FILM 200-OHM 1/10W 1% MIL-R-10509	EA	2	R01 02	
015	RN55C2742F / 741554-274		RES FILM 27.4K 1/10W 1% MIL-R-10509	EA	1	R07	
016	CF1/4-270-OHMS/J / 744072-270	09021	RES FILM 270-OHM 1/4W 5%	EA	1	R12	
017	RN55C2743F / 741555-274		RES FILM 274K 1/10W 1% MIL-R-10509	EA	1	R06	
018	CF1/4-4.7K/J / 744073-470	09021	RES FILM 4.7K 1/4W 5%	EA	1	R11	
019	RN55C8251F / 741553-825		RES FILM 8.25K 1/10W 1% MIL-R-10509	EA	1	R09	SEE NOTE 1

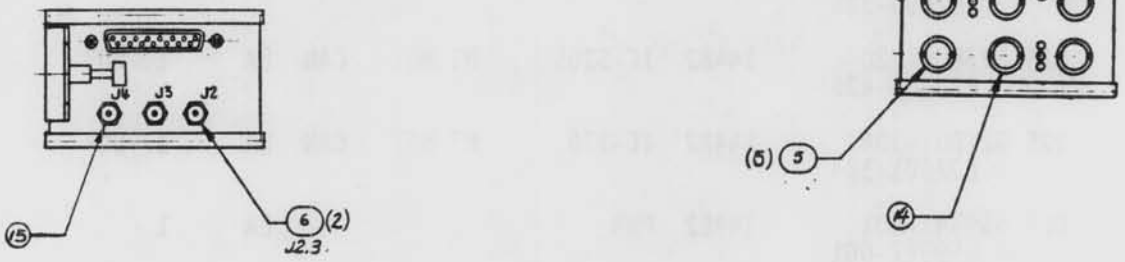
Figure 5-18. AGC CCA A10A6 and A7 Parts List, Part No. 659540 (Sheet 2 of 3)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
020	RN55C9090F 741552-909		RES FILM 909-OHM 1/10W 1% MIL-R-10509	EA	1	R04
021	JAN1N751A 771000-005		DIO ZR 5.1V .4W 5% A298 MIL-S-19500	EA	1	VR02
022	JAN1N753A 771000-007		DIO ZR 6.2V .4W 5% A298 MIL-S-19500	EA	1	VR01
023	WJ61 990009-259	14482	IC-VOLT CONT ATTEN	EA	1	U01
024	627603-326 627603-326	14482	IC-34002 CT PLSTC DIP	EA	1	U02
025	627605-420 627605-420	14482	IC-5205 MT MET CAN	EA	1	U03
026	627601-304 627601-304	14482	IC-130 MT MET CAN	EA	1	U04
027	659541-001 659541-001	14482	PWB	EA	1	
028	10-31-1063 799100-015	27264	CONN PLUG STRAIGHT	EA	1	J01
029	659543 659543	14482	SCHEM DIAG	EA	REF	A6C-1
030	659539 659539	14482	SCHEM DIAG	EA	REF	A6C-2
031	CK05BX222K 750153-220		CAP CER 2200PF 100V 10% MIL-C-11015	EA	1	C10
032	RCR076150JS 740071-150		RES CMPSN 15-OHM 1/4W 5% MIL-R-39008	EA	1	R14
033	100-100-NP0-519C 759160-510	51642	CAP CER 5.1PF 100V .25PF	EA	1	C20
034	CK06BX222K 751203-220		CAP CER 2200PF 200V 10% MIL-C-11015 EXPLOSION FINISHED	EA	1	C21

NOTES: UNLESS OTHERWISE SPECIFIED

1: FACTORY SELECT. INSTALL NOMINAL VALUE SHOWN.

Figure 5-18. AGC CCA A10A6 and A7 Parts List, Part No. 659540 (Sheet 3 of 3)



[4] SOLDER CABLE SHIELD TO E19

[3] SOLDER CABLE SHIELD TO GND PLANE

2. REFERENCE DESIGNATIONS ARE FOR REFERENCE ONLY AND MAY OR MAY NOT APPEAR ON PART.

1. SOLDER PER MIL-STD-454 REQUIREMENTS

NOTES: UNLESS OTHERWISE SPECIFIED

Figure 5-19. Demodulator A11 Parts List, Part No. 659552 (Sheet 1 of 3)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
001	480857-1 659554-001	14482	ASSY-CHAS	EA	1	
002	660111-001 660111-001	14482	ASSY-CCA DELAY LINE	EA	1	
003	659561-001 659561-001	14482	ASSY-CCA DETECTOR	EA	1	A01
004	659565-001 659565-001	14482	ASSY-CCA VIDEO SWITCHER	EA	1	A02
005	U61094A/U 090552-000		CONN RCPT BNC BHD SLDR	EA	5	
006	OSM211 090999-175	16179	CONN JACK SMA RCTP BHD FT	EA	2	J02 03
007	660725-001 660725-001	14482	COVER	EA	2	
008	24AWG-TY-E-9 430240-009		WIRE TFL WHT MILW16878 MIL-W-16878	FT	AR	
013	381134 659553	14482	SCHEM DIAG	EA	REF	
014	660144-008 660144-008	14482	ASSY-CABLE FLEX	EA	1	
015	660144-009 660144-009	14482	ASSY-CABLE FLEX	EA	1	
			EXPLOSION FINISHED			

Figure 5-19. Demodulator A11 Parts List, Part No. 659552 (Sheet 2 of 3)

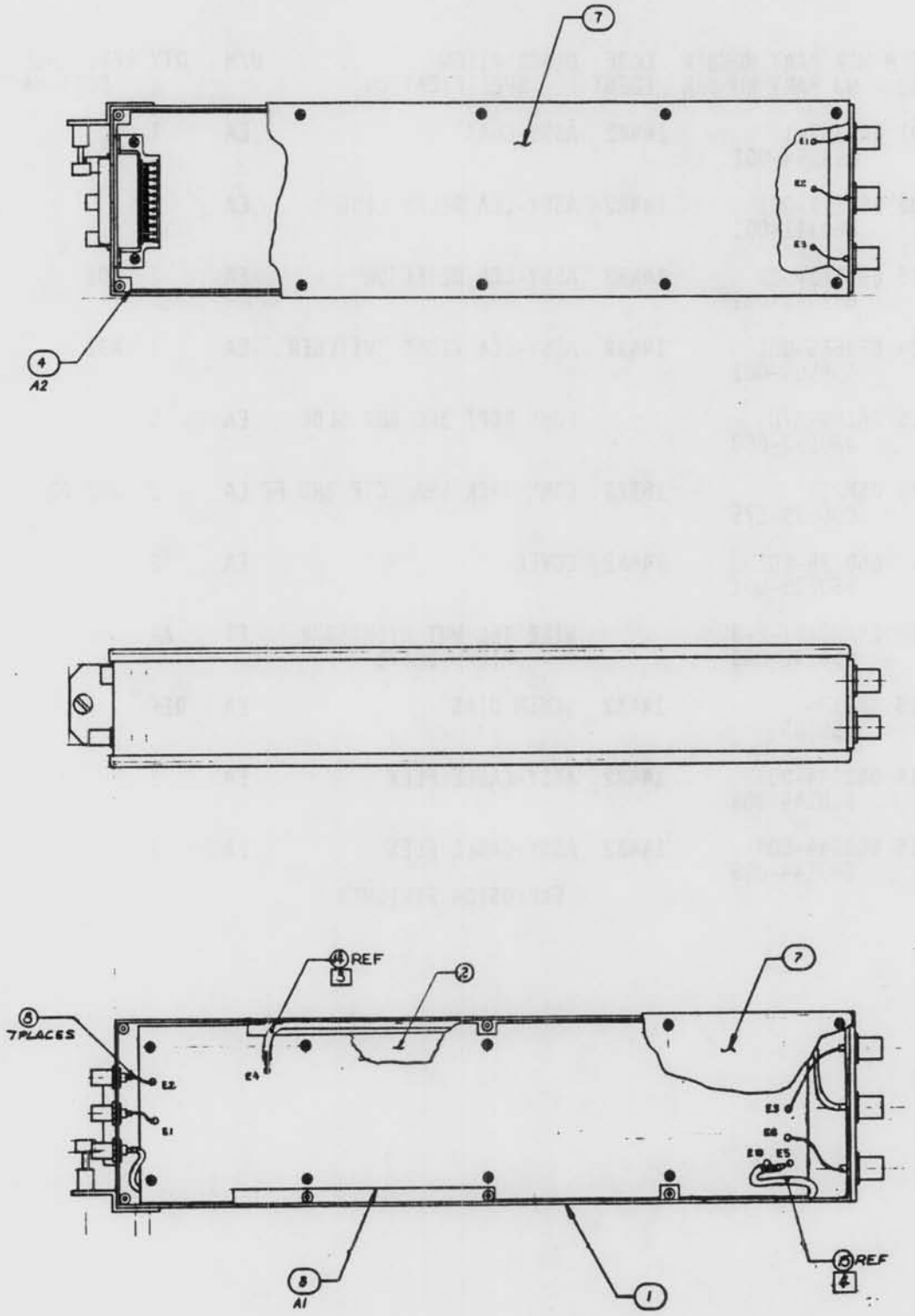
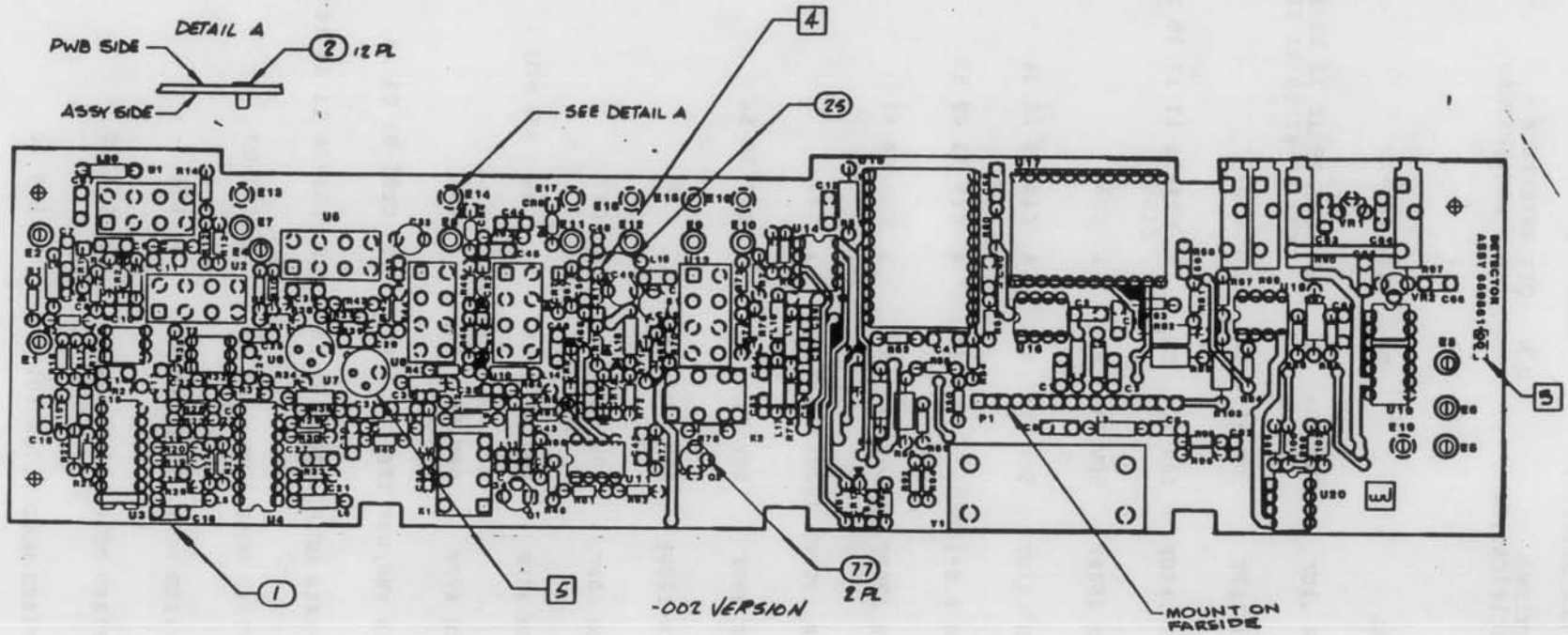


Figure 5-19. Demodulator A11 Parts List, Part No. 659552 (Sheet 3 of 3)



659561B

5 SOLDER CASE OF U6&U7 TO GND PLANE

4 INSTALL CR12 WITH CATHODE TOWARD ROUND PAD. MOUNT CR12 ONLY IN THIS MANNER

3 MARK DASH NUMBER PER MIL STD 130 APPROXIMATELY WHERE SHOWN USING 12 HIGH CHARACTERS WITH WHITE INK COLOR NO 17875 PER FED-STD 595

2. OBSERVE POLARITY OF CAPACITORS AND SEMICONDUCTOR DEVICES.

1. SOLDER PER MIL-STD-454

NOTES: UNLESS OTHERWISE SPECIFIED

Figure 5-20. Detector CCA A11A1 Parts List, Part No. 659561
(Sheet 1 of 9)

ASSEMBLY NO: 659561-001 ASSY-CCA DETECTOR REV. C

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
001	659562-001 659562-001	14482	PWB	EA	1	
002	3388-1-03 528200-016	71279	TERMINAL	EA	12	E07-18
003	660073-104 660073-104	14482	CAP CER .1UF 50V 20%	EA	27	C07 09 10 12 13 16 21 25 28 29 C31 40-47 50 51 58-61 64 66
004	660073-100 660073-100	14482	CAP CER 10PF 50V 5%	EA	1	C55
005	660073-474 660073-474	14482	CAP CER .47UF 50V 20%	EA	15	C01-06 11 17 18 22 23 27 30 63 C65
007	660073-151 660073-151	14482	CAP CER 150PF 50V 5%	EA	1	C08
008	660073-103 660073-103	14482	CAP CER .01UF 50V 20%	EA	4	C14 19 20 24
009	9402-2SL-2 990018-733	91293	CAP VAR 2.5-10PF	EA	4	C15 33 49 52
010	660073-391 660073-391	51642	CAP CER 390PF 50V 5%	EA	3	C34 36 67
011	150-100-NP0-132G 759173-130	51642	CAP CER 1300PF 100V 2%	EA	1	C35
012	660073-390 660073-390	51642	CAP CER 39PF 50V 5%	EA	3	C37 39 56
013	660073-121 660073-121	51642	CAP CER 120PF 50V 5%	EA	1	C38
014	660073-680 660073-680	51642	CAP CER 68PF 50V 5%	EA	1	C62
015	660073-330 660073-330	14482	CAP CER 33PF 50V 5%	EA	1	C48 SEE NOTE 1
016	660073-470 660073-470	51642	CAP CER 47PF 50V 5%	EA	1	C57
017	5082-3188 990018-292	28480	DIO PIN VHF/UHF 1PF	EA	12	CR01-03 05-13
018	1025-36 760041-470	99800	COIL FIXED MOLD 4.7UH 10%	EA	8	L05-08 13 14 16 20
019	1025-44 760042-100	99800	COIL FIXED MOLD 10UH 10%	EA	3	L01-03
020	1025-08 760040-330	99800	COIL FIXED MOLD .33UH 10%	EA	1	L04
021	1025-06 760040-270	99800	COIL FIXED MOLD .27UH 10%	EA	2	L11 12
022	1025-30 760041-270	99800	COIL FIXED MOLD 2.7UH 10%	EA	2	L09 10

Figure 5-20. Detector CCA A11A1 Parts List, Part No. 659561
(Sheet 2 of 9)

ASSEMBLY NO: 659561-001 ASSY-CCA DETECTOR REV. C

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
023	1025-26 760041-180	99800	COIL FIXED MOLD 1.8UH 10%	EA	1	L17
024	1025-40 760041-680	99800	COIL FIXED MOLD 6.8UH 10%	EA	1	L18
025	24AWG-TY-E-9 430240-009		WIRE TFL WHT MILW16878 MIL-W-16878	FT	1	L15 SEE NOTE 1
027	1025-46 760042-120	99800	COIL FIXED MOLD 12UH 10%	EA	1	L19
028	CF1/8-27-OHMS/J 744051-270	09021	RES FILM 27-OHM 1/8W 5%	EA	1	R03
029	CF1/8-1K/J 744053-100	09021	RES FILM 1K 1/8W 5%	EA	8	R02 05 63 65-68 91
030	CF1/8-51-OHMS/J 744051-510	09021	RES FILM 51-OHM 1/8W 5%	EA	4	R01 04 76 102
031	CF1/8-220K/J 744055-220	09021	RES FILM 220K 1/8W 5%	EA	3	R06 61 98
032	CF1/8-47K/J 744054-470	09021	RES FILM 47K 1/8W 5%	EA	4	R07 59 60 62
033	CF1/8-300-OHMS/J 744052-300	09021	RES FILM 300-OHM 1/8W 5%	EA	8	R13 14 38 39 42 44 46 47
034	CF1/8-62-OHMS/J 744051-620	09021	RES FILM 62-OHM 1/8W 5%	EA	2	R10 11
035	CF1/8-18-OHMS/J 744051-180	09021	RES FILM 18-OHM 1/8W 5%	EA	4	R12 37 43 45
036	CF1/8-2.2K/J 744053-220	09021	RES FILM 2.2K 1/8W 5%	EA	8	R15 16 21-24 31 32
037	CF1/8-470-OHMS/J 744052-470	09021	RES FILM 470-OHM 1/8W 5%	EA	13	R08 19 20 25 26 29 30 33 34 64 R72 78 79
038	CF1/8-36-OHMS/J 744051-360	09021	RES FILM 36-OHM 1/8W 5%	EA	3	R70 73 92
039	CF1/8-47-OHMS/J 744051-470	09021	RES FILM 47-OHM 1/8W 5%	EA	5	R17 18 27 28 35
040	CF1/8-8.2-OHMS/J 744050-820	09021	RES FILM 8.2-OHM 1/8W 5%	EA	2	R36 40
041	CF1/8-150-OHMS/J 744052-150	09021	RES FILM 150-OHM 1/8W 5%	EA	6	R69 71 74 75 93 94
042	RN55C30R1F 741551-301		RES FILM 30.1-OHM 1/10W MIL-R-10509	EA	4	R49 56 82 87
044	CF1/8-10K/J 744054-100	09021	RES FILM 10K 1/8W 5%	EA	10	R48 50 52 55 77 83 84 86 99 100

Figure 5-20. Detector CCA A11A1 Parts List, Part No. 659561
(Sheet 3 of 9)

ASSEMBLY NO: 659561-001 ASSY-CCA DETECTOR REV. C

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
045	CF1/8-22-OHMS/J 744051-220	09021	RES FILM 22-OHM 1/8W 5%	EA	4	R53 54 80 81
046	RN55C1501F 741553-150		RES FILM 1.5K 1/10W 1% MIL-R-10509	EA	2	R85 103
047	CF1/8-330K/J 744055-330	09021	RES FILM 330K 1/8W 5%	EA	1	R57
048	CF1/8-33K/J 744054-330	09021	RES FILM 33K 1/8W 5%	EA	1	R88
049	CF1/8-100K/J 744055-100	09021	RES FILM 100K 1/8W 5%	EA	1	R96
050	CF1/8-4.7K/J 744053-470	09021	RES FILM 4.7K 1/8W 5%	EA	1	R95
051	RN55C47R5F 741551-475		RES FILM 47.5OHM 1/10W 1% MIL-R-10509	EA	1	R51
052	89PR100K 990018-297	73138	RES VAR SCR ADJ 100K 10%	EA	4	R58 89 90 97
053	T1-1 990018-298	15542	XFMR RF 10KHZ-500KHZ	EA	2	T01 02
054	PSC-2-1W 990018-636	15542	PWR DIVIDER 1-650MHZ 2WAY	EA	4	U01 02 05 10
055	627601-063 627601-063	14482	IC-1458 CT PLSTC DIP	EA	2	U11 14
056	627601-385 627601-385	14482	IC-10H116 CT PLSTC DIP	EA	2	U03 04
057	627602-028 627602-028	14482	IC-230 CT MET CAN	EA	2	U06 07
058	SRA-1W 990018-638	15542	MIXER LO RF/IF	EA	2	U08 12
059	627603-016 627603-016	14482	IC-300 CT PLSTC DIP	EA	2	U15 17
060	627601-232 627601-232	14482	IC-1007 CT PLSTC DIP	EA	3	U16 18 20
061	627601-223 627601-223	14482	IC-188 IT CER DIP	EA	1	U19
062	627607-781 627607-781	14482	IC-78L12 CT PLSTC DIP	EA	1	VR01
063	627607-699 627607-699	14482	IC-79L12 CT PLSTC DIP	EA	1	VR02
064	SSA-122-S-T 791090-003	55322	SOCKET STRIP	EA	4	XU15 17
068	FBR42D005 990018-717		RELAY	EA	2	K01 02

Figure 5-20. Detector CCA A11A1 Parts List, Part No. 659561 (Sheet 4 of 9)

ASSEMBLY NO: 659561-001 ASSY-CCA DETECTOR REV. C

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
069	SSW-116-01-G-S 990018-296	55322	HEADER 16 PIN	EA	1	P01
070	659564 659564	14482	SCHEM DIAG	EA	REF	
071	CF1/8-220-OHMS/J 744052-220	09021	RES FILM 220-OHM 1/8W 5%	EA	1	R09
072	2N2222A 780000-002B	80131	XSTR NPN HI-SPD MED PWR	EA	2	Q01 02
075	100-100-NP0-209B 759160-200	51642	CAP CER 2PF 100V .1PF	EA	1	C53 SEE NOTE 1
076	100-100-NP0-109B 759160-100	51642	CAP CER 1PF 100V .1PF	EA	1	C54 SEE NOTE 1
077	10109DAP 702023-003	07047	INSULATOR PAD TO-18	EA	2	XQ01 02
079	660073-474* 660073-474*	14482	CAP CER .47UF 50V 20%	EA	1	C32 SEE NOTE 1

EXPLOSION FINISHED

ASSEMBLY NO: 659561-002 ASSY-CCA DETECTOR REV. C

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
001	659562-001 659562-001	14482	PWB	EA	1	
002	3388-1-03 528200-016	71279	TERMINAL	EA	12	E07-18
003	660073-104 660073-104	14482	CAP CER .1UF 50V 20%	EA	27	C07 09 10 12 13 16 21 25 28 29 C31 40-47 50 51 58-61 64 66
004	660073-100 660073-100	14482	CAP CER 10PF 50V 5%	EA	1	C55
005	660073-474 660073-474	14482	CAP CER .47UF 50V 20%	EA	15	C01-06 11 17 18 22 23 27 30 63 C65
007	660073-151 660073-151	14482	CAP CER 150PF 50V 5%	EA	1	C08
008	660073-103 660073-103	14482	CAP CER .01UF 50V 20%	EA	4	C14 19 20 24
009	9402-2SL-2 990018-733	91293	CAP VAR 2.5-10PF	EA	4	C15 33 49 52
010	660073-391 660073-391	51642	CAP CER 390PF 50V 5%	EA	3	C34 36 67

Figure 5-20. Detector CCA A11A1 Parts List, Part No. 659561
(Sheet 5 of 9)

ASSEMBLY NO: 659561-002 ASSY-CCA DETECTOR REV. C

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
011	150-100-NP0-132G 759173-130	51642	CAP CER 1300PF 100V 2%	EA	1	C35
012	660073-390 660073-390	51642	CAP CER 39PF 50V 5%	EA	3	C37 39 56
013	660073-121 660073-121	51642	CAP CER 120PF 50V 5%	EA	1	C38
014	660073-680 660073-680	51642	CAP CER 68PF 50V 5%	EA	1	C62
015	660073-330 660073-330	14482	CAP CER 33PF 50V 5%	EA	1	C48 SEE NOTE 1
016	660073-470 660073-470	51642	CAP CER 47PF 50V 5%	EA	1	C57
017	5082-3188 990018-292	28480	DIO PIN VHF/UHF 1PF	EA	12	CR01-03 05-13
018	1025-36 760041-470	99800	COIL FIXED MOLD 4.7UH 10%	EA	8	L05-08 13 14 16 20
019	1025-44 760042-100	99800	COIL FIXED MOLD 10UH 10%	EA	3	L01-03
020	1025-08 760040-330	99800	COIL FIXED MOLD .33UH 10%	EA	1	L04
021	1025-06 760040-270	99800	COIL FIXED MOLD .27UH 10%	EA	2	L11 12
022	1025-30 760041-270	99800	COIL FIXED MOLD 2.7UH 10%	EA	2	L09 10
023	1025-26 760041-180	99800	COIL FIXED MOLD 1.8UH 10%	EA	1	L17
024	1025-40 760041-680	99800	COIL FIXED MOLD 6.8UH 10%	EA	1	L18
025	24AWG-TY-E-9 430240-009		WIRE TFL WHT MILW16878 MIL-W-16878	FT	1	L15 SEE NOTE 1
027	1025-46 760042-120	99800	COIL FIXED MOLD 12UH 10%	EA	1	L19
028	CF1/8-27-OHMS/J 744051-270	09021	RES FILM 27-OHM 1/8W 5%	EA	1	R03
029	CF1/8-1K/J 744053-100	09021	RES FILM 1K 1/8W 5%	EA	8	R02 05 63 65-68 91
030	CF1/8-51-OHMS/J 744051-510	09021	RES FILM 51-OHM 1/8W 5%	EA	4	R01 04 76 102
031	CF1/8-220K/J 744055-220	09021	RES FILM 220K 1/8W 5%	EA	3	R06 61 98

Figure 5-20. Detector CCA A11A1 Parts List, Part No. 659561
(Sheet 6 of 9)

ASSEMBLY NO: 659561-002 ASSY-CCA DETECTOR REV. C

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
032	CF1/8-47K/J 744054-470	09021	RES FILM 47K 1/8W 5%	EA	4	R07 59 60 62
033	CF1/8-300-OHMS/J 744052-300	09021	RES FILM 300-OHM 1/8W 5%	EA	8	R13 14 38 39 42 44 46 47
034	CF1/8-62-OHMS/J 744051-620	09021	RES FILM 62-OHM 1/8W 5%	EA	2	R10 11
035	CF1/8-18-OHMS/J 744051-180	09021	RES FILM 18-OHM 1/8W 5%	EA	4	R12 37 43 45
036	CF1/8-2.2K/J 744053-220	09021	RES FILM 2.2K 1/8W 5%	EA	8	R15 16 21-24 31 32
037	CF1/8-470-OHMS/J 744052-470	09021	RES FILM 470-OHM 1/8W 5%	EA	13	R08 19 20 25 26 29 30 33 34 64 R72 78 79
038	CF1/8-36-OHMS/J 744051-360	09021	RES FILM 36-OHM 1/8W 5%	EA	3	R70 73 92
039	CF1/8-47-OHMS/J 744051-470	09021	RES FILM 47-OHM 1/8W 5%	EA	5	R17 18 27 28 35
040	CF1/8-8.2-OHMS/J 744050-820	09021	RES FILM 8.2-OHM 1/8W 5%	EA	2	R36 40
041	CF1/8-150-OHMS/J 744052-150	09021	RES FILM 150-OHM 1/8W 5%	EA	6	R69 71 74 75 93 94
042	RN55C30R1F 741551-301		RES FILM 30.1-OHM 1/10W MIL-R-10509	EA	4	R49 56 82 87
044	CF1/8-10K/J 744054-100	09021	RES FILM 10K 1/8W 5%	EA	10	R48 50 52 55 77 83 84 86 99 100
045	CF1/8-22-OHMS/J 744051-220	09021	RES FILM 22-OHM 1/8W 5%	EA	4	R53 54 80 81
046	RN55C1501F 741553-150		RES FILM 1.5K 1/10W 1% MIL-R-10509	EA	2	R85 103
047	CF1/8-330K/J 744055-330	09021	RES FILM 330K 1/8W 5%	EA	1	R57
048	CF1/8-33K/J 744054-330	09021	RES FILM 33K 1/8W 5%	EA	1	R88
049	CF1/8-100K/J 744055-100	09021	RES FILM 100K 1/8W 5%	EA	1	R96
050	CF1/8-4.7K/J 744053-470	09021	RES FILM 4.7K 1/8W 5%	EA	1	R95
051	RN55C47R5F 741551-475		RES FILM 47.5OHM 1/10W 1% MIL-R-10509	EA	1	R51
052	89PR100K 990018-297	73138	RES VAR SCR ADJ 100K 10%	EA	4	R58 89 90 97

Figure 5-20. Detector CCA A11A1 Parts List, Part No. 659561
(Sheet 7 of 9)

ASSEMBLY NO: 659561-002 ASSY-CCA DETECTOR REV. C

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
053	T1-1 990018-298	15542	XFMR RF 10KHZ-500KHZ	EA	2	T01 02
054	PSC-2-1W 990018-636	15542	PWR DIVIDER 1-650MHZ 2WAY	EA	4	U01 02 05 10
055	627601-063 627601-063	14482	IC-1458 CT PLSTC DIP	EA	2	U11 14
056	627601-385 627601-385	14482	IC-10H116 CT PLSTC DIP	EA	2	U03 04
057	627602-028 627602-028	14482	IC-230 CT MET CAN	EA	2	U06 07
058	SRA-1W 990018-638	15542	MIXER LO RF/IF	EA	2	U08 12
059	627603-016 627603-016	14482	IC-300 CT PLSTC DIP	EA	2	U15 17
060	627601-232 627601-232	14482	IC-1007 CT PLSTC DIP	EA	3	U16 18 20
061	627601-223 627601-223	14482	IC-188 IT CER DIP	EA	1	U19
062	627607-781 627607-781	14482	IC-78L12 CT PLSTC DIP	EA	1	VR01
063	627607-699 627607-699	14482	IC-79L12 CT PLSTC DIP	EA	1	VR02
064	SSA-122-S-T 791090-003	55322	SOCKET STRIP	EA	4	XU15 17
065	660107-001 660107-001	14482	XTAL DSCMR 21.4MHZ 300KHZ	EA	1	Y01
068	FBR42D005 990018-717		RELAY	EA	2	K01 02
069	SSW-116-01-G-S 990018-296	55322	HEADER 16 PIN	EA	1	P01
070	659564 659564	14482	SCHEM DIAG	EA	REF	
071	CF1/8-220-OHMS/J 744052-220	09021	RES FILM 220-OHM 1/8W 5%	EA	1	R09

Figure 5-20. Detector CCA A11A1 Parts List, Part No. 659561
(Sheet 8 of 9)

ASSEMBLY NO: 659561-002 ASSY-CCA DETECTOR REV. C

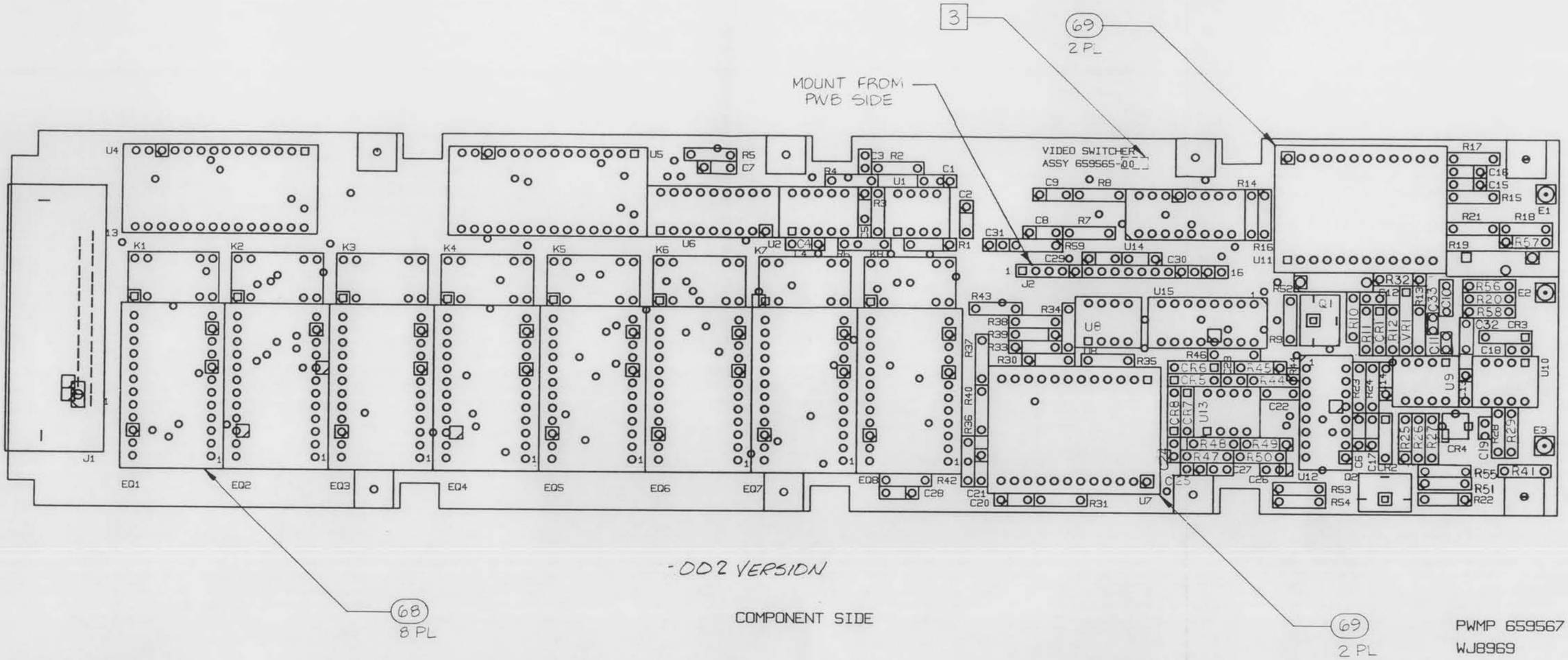
ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS	
072	2N2222A 780000-002B	80131	XSTR NPN HI-SPD MED PWR	EA	2	Q01 02	
075	100-100-NP0-209B 759160-200	51642	CAP CER 2PF 100V .1PF	EA	1	C53	SEE NOTE 1
076	100-100-NP0-109B 759160-100	51642	CAP CER 1PF 100V .1PF	EA	1	C54	SEE NOTE 1
077	10109DAP 702023-003	07047	INSULATOR PAD TO-18	EA	2	XQ01 02	
079	660073-474* 660073-474*	14482	CAP CER .47UF 50V 20%	EA	1	C32	SEE NOTE 1

EXPLOSION FINISHED

NOTES: UNLESS OTHERWISE SPECIFIED

1. FACTORY SELECT. USE NOMINAL VALUE SHOWN.

Figure 5-20. Detector CCA A11A1 Parts List, Part No. 659561
(Sheet 9 of 9)



3 MARK DASH NUMBER PER MIL-STD-130 APPROXIMATELY WHERE SHOWN USING .12 HIGH CHARACTERS WITH WHITE INK COLOR NO 17875 PER FED-STD-595

2. OBSERVE POLARITY OF CAPACITORS AND SEMICONDUCTOR DEVICES

1. SOLDER PER MIL-STD-454

NOTES: UNLESS OTHERWISE SPECIFIED

659565A

Figure 5-21. Video Switcher CCA A11A2 Parts List, Part No. 659565 (Sheet 1 of 7)

ASSEMBLY NO: 659565-001 ASSY-CCA VIDEO SWITCHER REV. B

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
001	659566-001 / 659566-001	14482	PWB	EA	1	
002	660073-104 / 660073-104	14482	CAP CER .1UF 50V 20%	EA	9	C06 07 13-16 20-22
004	C330C105M5V5CA / 752100-100	59660	CAP CER 1UF 50V	EA	3	C08 09 28
005	660073-103 / 660073-103	14482	CAP CER .01UF 50V 20%	EA	3	C10 17 32
006	150-100-NP0-330G / 759161-330	51642	CAP CER 33PF 100V 2%	EA	1	C11
007	100-100-NP0-XXX / 990019-143	51642	CAP CER 0 100V	EA	1	C12 SEE NOTE 1
008	150-100-NP0-270G / 759161-270	51642	CAP CER 27PF 100V 2%	EA	1	C18
009	150-100-NP0-471G / 759162-470	51642	CAP CER 470PF 100V 2%	EA	1	C19
010	200-100-NP0-101G / 759162-100	51642	CAP CER 100PF 100V 2%	EA	1	C23
011	200-100-NP0-222G / 759163-220	51642	CAP CER 2200PF 100V 2%	EA	2	C24 25
012	100-100-NP0-229B / 759160-220	51642	CAP CER 2.2PF 100V .1PF	EA	2	C26 27
013	660073-474 / 660073-474	14482	CAP CER .47UF 50V 20%	EA	2	C29 30
014	5082-2800 / 775000-002	28480	DIO HOT CARRER 1/4W 70V	EA	2	CR01 02
015	1N4449 / 775000-001	80131	DIO HI COND HS SW 75PPV	EA	5	CR03 05-08
016	PAD5 / 990018-421	17856	DIO LO-LEAK PICO-AMP	EA	1	CR04
018	56-724-005 / 990018-263	33095	CONN FLTR 25PIN "D"	EA	1	J01
019	HE721C0500 / 990018-684	83250	DUAL-IN-LINE REED RELAY	EA	8	K01-08
021	BFR96-S / 990018-685	73445	XSTR NPN 500MHZ SOT-37 CS	EA	2	Q01 02
023	CF1/8-10K/J / 744054-100	09021	RES FILM 10K 1/8W 5%	EA	6	R07 08 34 35 38 45
024	CF1/8-100-OHMS/J / 744052-100	09021	RES FILM 100-OHM 1/8W 5%	EA	9	R14 16 18 20 41 51 53 54 57

Figure 5-21. Video Switcher CCA A11A2 Parts List, Part No. 659565 (Sheet 2 of 7)

ASSEMBLY NO: 659565-001 ASSY-CCA VIDEO SWITCHER REV. B

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
026	CF1/8-22-OHMS/J 744051-220	09021	RES FILM 22-OHM 1/8W 5%	EA	4	R15 17 31 36
027	CF1/8-1K/J 744053-100	09021	RES FILM 1K 1/8W 5%	EA	6	R13 21 40 42 55 56
028	CF1/8-47-OHMS/J 744051-470	09021	RES FILM 47-OHM 1/8W 5%	EA	3	R09 10 22
029	CF1/8-220-OHMS/J 744052-220	09021	RES FILM 220-OHM 1/8W 5%	EA	1	R11
030	RCR05G106JS 740057-100		RES CMPSN 10MEG 1/8W 5% MIL-R-39008	EA	6	R12 24 47-50
031	CF1/8-470-OHMS/J 744052-470	09021	RES FILM 470-OHM 1/8W 5%	EA	2	R29 58
033	89PR1K 748063-100	73138	RES VAR SCR ADJ 1K 10%	EA	1	R19
035	CF1/8-1.3K/J 744053-130	09021	RES FILM 1.3K 1/8W 5%	EA	1	R23
036	RN55C1502F 741554-150		RES FILM 15K 1/10W 1% MIL-R-10509	EA	2	R25 26
037	RN55C1002F 741554-100		RES FILM 10K 1/10W 1% MIL-R-10509	EA	2	R27 28
038	CF1/8-100K/J 744055-100	09021	RES FILM 100K 1/8W 5%	EA	2	R32 44
039	RN55C75R0F 741551-750		RES FILM 75-OHM 1/10W 1% MIL-R-10509	EA	2	R33 39
040	RN55C1501F 741553-150		RES FILM 1.5K 1/10W 1% MIL-R-10509	EA	2	R37 52
041	CF1/8-82K/J 744054-820	09021	RES FILM 82K 1/8W 5%	EA	1	R43
042	CF1/8-3.3K/J 744053-330	09021	RES FILM 3.3K 1/8W 5%	EA	1	R46
045	627602-243 627602-243	14482	IC-2803 MT CER DIP	EA	1	U06
046	627605-618 627605-618	14482	IC-507 CT PLSTC DIP	EA	2	U04 05
047	627603-016 627603-016	14482	IC-300 CT PLSTC DIP	EA	2	U07 11
048	627601-232 627601-232	14482	IC-1007 CT PLSTC DIP	EA	1	U08
049	627603-326 627603-326	14482	IC-34002 CT PLSTC DIP	EA	3	U09 10 13

Figure 5-21. Video Switcher CCA A11A2 Parts List, Part No. 659565 (Sheet 3 of 7)

ASSEMBLY NO: 659565-001 ASSY-CCA VIDEO SWITCHER REV. B

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
050	627603-232 627603-232	14482	IC-384 CT PLSTC DIP	EA	1	U12
051	1N759A 771000-018B		DIO ZR 12.0V .4W 5% DO7	EA	1	VR01
065	659568 659568	14482	SCHEM DIAG	EA	REF	
067	627601-265 627601-265	14482	IC-190 IT PLSTC DIP	EA	2	U14 15
068	524-AG11D 090589-000	91506	SOCKET PC 24CONT DIP	EA	8	XEQ01-08
069	SSK-112-ST 791090-004	55322	SOCKET 12PIN	EA	4	XU07 11
072	660073-331 660073-331	14482	CAP CER 330PF 50V 5%	EA	1	C33
073	RN55C5110F 741552-511		RES FILM 511-OHM 1/10W 1% MIL-R-10509	EA	1	R30
074	TSW-116-07-G-S 990018-264	55322	HEADER 16 PIN	EA	1	J02

EXPLOSION FINISHED

ASSEMBLY NO: 659565-002 ASSY-CCA VIDEO SWITCHER REV. B

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
001	659566-001 659566-001	14482	PWB	EA	1	
002	660073-104 660073-104	14482	CAP CER .1UF 50V 20%	EA	13	C01 02 04 05 06 07 13-16 20-22
003	100-100-NP0-339B 759160-330	51642	CAP CER 3.3PF 100V .1PF	EA	1	C03
004	C330C105M5V5CA 752100-100	59660	CAP CER 1UF 50V	EA	3	C08 09 28
005	660073-103 660073-103	14482	CAP CER .01UF 50V 20%	EA	3	C10 17 32
006	150-100-NP0-330G 759161-330	51642	CAP CER 33PF 100V 2%	EA	1	C11
007	100-100-NP0-XXX 990019-143	51642	CAP CER 0 100V	EA	1	C12 SEE NOTE 1
008	150-100-NP0-270G 759161-270	51642	CAP CER 27PF 100V 2%	EA	1	C18

Figure 5-21. Video Switcher CCA A11A2 Parts List, Part No. 659565 (Sheet 4 of 7)

ASSEMBLY NO: 659565-002 ASSY-CCA VIDEO SWITCHER REV. B

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
009	150-100-NP0-471G 759162-470	51642	CAP CER 470PF 100V 2%	EA	1	C19
010	200-100-NP0-101G 759162-100	51642	CAP CER 100PF 100V 2%	EA	1	C23
011	200-100-NP0-222G 759163-220	51642	CAP CER 2200PF 100V 2%	EA	2	C24 25
012	100-100-NP0-229B 759160-220	51642	CAP CER 2.2PF 100V .1PF	EA	2	C26 27
013	660073-474 660073-474	14482	CAP CER .47UF 50V 20%	EA	2	C29 30
014	5082-2800 775000-002	28480	DIO HOT CARRER 1/4W 70V	EA	2	CR01 02
015	1N4449 775000-001	80131	DIO HI COND HS SW 75PPV	EA	5	CR03 05-08
016	PAD5 990018-421	17856	DIO LO-LEAK PICO-AMP	EA	1	CR04
018	56-724-005 990018-263	33095	CONN FLTR 25PIN "D"	EA	1	J01
019	HE721C0500 990018-684	83250	DUAL-IN-LINE REED RELAY	EA	8	K01-08
021	BFR96-S 990018-685	73445	XSTR NPN 500MHZ SOT-37 CS	EA	2	Q01 02
023	CF1/8-10K/J 744054-100	09021	RES FILM 10K 1/8W 5%	EA	7	R02 07 08 34 35 38 45
024	CF1/8-100-OHMS/J 744052-100	09021	RES FILM 100-OHM 1/8W 5%	EA	10	R03 14 16 18 20 41 51 53 54 57
026	CF1/8-22-OHMS/J 744051-220	09021	RES FILM 22-OHM 1/8W 5%	EA	6	R05 06 15 17 31 36
027	CF1/8-1K/J 744053-100	09021	RES FILM 1K 1/8W 5%	EA	6	R13 21 40 42 55 56
028	CF1/8-47-OHMS/J 744051-470	09021	RES FILM 47-OHM 1/8W 5%	EA	3	R09 10 22
029	CF1/8-220-OHMS/J 744052-220	09021	RES FILM 220-OHM 1/8W 5%	EA	1	R11
030	RCR05G106JS 740057-100		RES CMPSN 10MEG 1/8W 5% MIL-R-39008	EA	6	R12 24 47-50
031	CF1/8-470-OHMS/J 744052-470	09021	RES FILM 470-OHM 1/8W 5%	EA	2	R29 58
032	RN55C5110F 741552-511		RES FILM 511-OHM 1/10W 1% MIL-R-10509	EA	1	R30

Figure 5-21. Video Switcher CCA A11A2 Parts List, Part No. 659565
(Sheet 5 of 7)

ASSEMBLY NO: 659565-002 ASSY-CCA VIDEO SWITCHER REV. B

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
033	89PR1K 748063-100	73138	RES VAR SCR ADJ 1K 10%	EA	1	R19
035	CF1/8-1.3K/J 744053-130	09021	RES FILM 1.3K 1/8W 5%	EA	1	R23
036	RN55C1502F 741554-150		RES FILM 15K 1/10W 1% MIL-R-10509	EA	2	R25 26
037	RN55C1002F 741554-100		RES FILM 10K 1/10W 1% MIL-R-10509	EA	2	R27 28
038	CF1/8-100K/J 744055-100	09021	RES FILM 100K 1/8W 5%	EA	2	R32 44
039	RN55C75R0F 741551-750		RES FILM 75-OHM 1/10W 1% MIL-R-10509	EA	2	R33 39
040	RN55C1501F 741553-150		RES FILM 1.5K 1/10W 1% MIL-R-10509	EA	2	R37 52
041	CF1/8-82K/J 744054-820	09021	RES FILM 82K 1/8W 5%	EA	1	R43
042	CF1/8-3.3K/J 744053-330	09021	RES FILM 3.3K 1/8W 5%	EA	1	R46
043	627603-313 627603-313	14482	IC-37 IT PLSTC DIP	EA	1	U01
044	627602-003 627602-003	14482	IC-0002 CT PLSTC DIP	EA	1	U02
045	627602-243 627602-243	14482	IC-2803 MT CER DIP	EA	1	U06
046	627605-618 627605-618	14482	IC-507 CT PLSTC DIP	EA	2	U04 05
047	627603-016 627603-016	14482	IC-300 CT PLSTC DIP	EA	2	U07 11
048	627601-232 627601-232	14482	IC-1007 CT PLSTC DIP	EA	1	U08
049	627603-326 627603-326	14482	IC-34002 CT PLSTC DIP	EA	3	U09 10 13
050	627603-232 627603-232	14482	IC-384 CT PLSTC DIP	EA	1	U12
051	1N759A 771000-018B		DIO ZR 12.0V .4W 5% DO7	EA	1	VR01
065	659568 659568	14482	SCHEM DIAG	EA	REF	
067	627601-265 627601-265	14482	IC-190 IT PLSTC DIP	EA	2	U14 15

Figure 5-21. Video Switcher CCA A11A2 Parts List, Part No. 659565 (Sheet 6 of 7)

ASSEMBLY NO: 659565-002 ASSY-CCA VIDEO SWITCHER REV. B

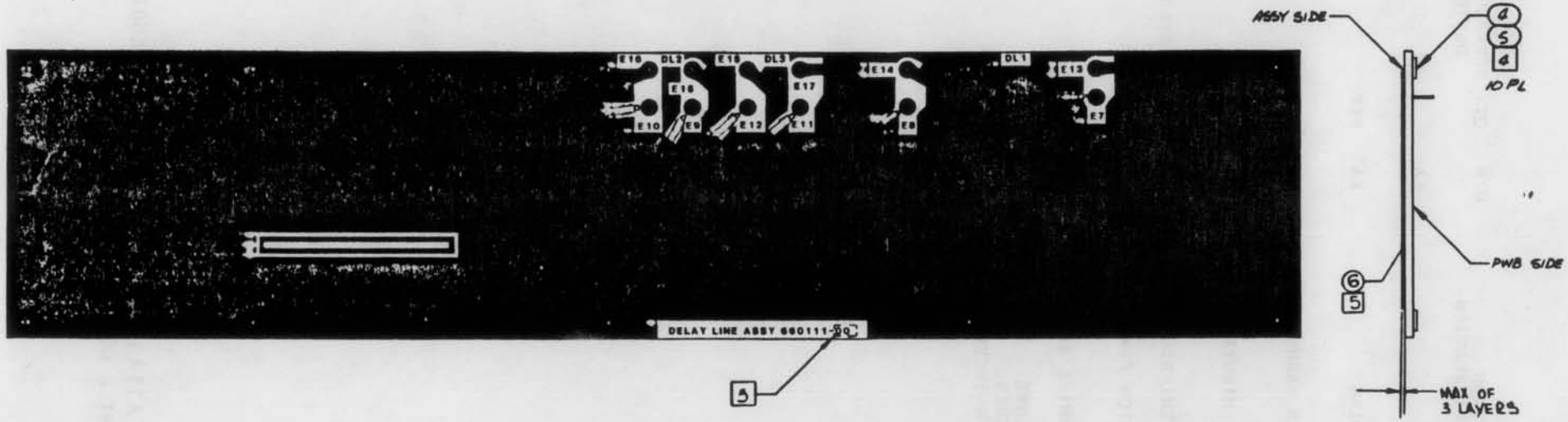
ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
068	524-AG11D 090589-000	91506	SOCKET PC 24CONT DIP	EA	8	XEQ01-08
069	SSK-112-ST 791090-004	55322	SOCKET 12PIN	EA	4	XU07 11
071	CF1/8-680-OHMS/J 744052-680	09021	RES FILM 680-OHM 1/8W 5%	EA	1	R59
072	660073-102 660073-102	14482	CAP CER 1000PF 50V 5%	EA	1	C31
073	660073-331 660073-331	14482	CAP CER 330PF 50V 5%	EA	1	C33
074	TSW-116-07-G-S 990018-264	55322	HEADER 16 PIN	EA	1	J02
075	RN55C1001F 741553-100		RES FILM 1K 1/10W 1% MIL-R-10509	EA	1	R01
076	RN55C9091F 741553-909		RES FILM 9.09K 1/10W 1% MIL-R-10509	EA	1	R04

EXPLOSION FINISHED

NOTES: UNLESS OTHERWISE SPECIFIED

1. FACTORY SELECT. NOMINAL VALUE Ø.

Figure 5-21. Video Switcher CCA A11A2 Parts List, Part No. 659565 (Sheet 7 of 7)



660111A

[5] DL1 - 47 IN., DL2 - 31 IN., DL3 - 20 FT.
ROUTE AND SOLDER CABLE ENDS AT E7 - E12 AS SHOWN. SOLDER CABLE JACKET TO GND. PLANE AS REQ'D TO HOLD DELAY LINES IN PLACE. KEEP MOUNTING HOLES & RECT. SLOT CLEAR AND KEEP DELAY LINES WITHIN PWB BOUNDARIES SEE DETAIL "A" FOR DETERMING LENGTH

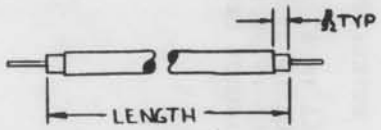
[4] BOND ITEM 4 TO PWB SIDE USING ITEM 8

[3] MARK DASH NUMBER PER MIL STD-130 APPROXIMATELY WHERE SHOWN USING 12 HIGH CHARACTERS WITH BLACK INK COLOR NO 17038 PER FED-STD-595

2. OBSERVE POLARITY OF CAPACITORS AND SEMICONDUCTOR DEVICES.

1. SOLDER PER MIL-STD-454

NOTES: UNLESS OTHERWISE SPECIFIED



DETAIL "A"

Figure 5-22. Delay Line CCA A11A3 Parts List, Part No. 660111
(Sheet 1 of 2)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
001	660112-001 660112-001	14482	PWB	EA	1	
002	660114 660114	14482	SCHEM DIAG	EA	REF	
004	2704-18550-PH116 580550-250	06540	SHOULDER WASHER	EA	10	
005	5MIN 405000-246	16059	EPOXY 5 MINUTE DEVCON	EA	AR	
006	DA50047 990018-856	64639	CABLE SEMI-RIGID	FT	30	SEE NOTE 1
			EXPLOSION FINISHED			

NOTES: UNLESS OTHERWISE SPECIFIED

1: LENGTH OF DL1 IS 47 AND 1/4 INCHES.
LENGTH OF DL2 IS 31 AND 1/4 INCHES.
LENGTH OF DL3 IS 20 FEET AND 1/4 INCHES
IN ONE CONTINUOUS LENGTH.

Figure 5-22. Delay Line CCA A11A3 Parts List, Part No. 660111
(Sheet 2 of 2)

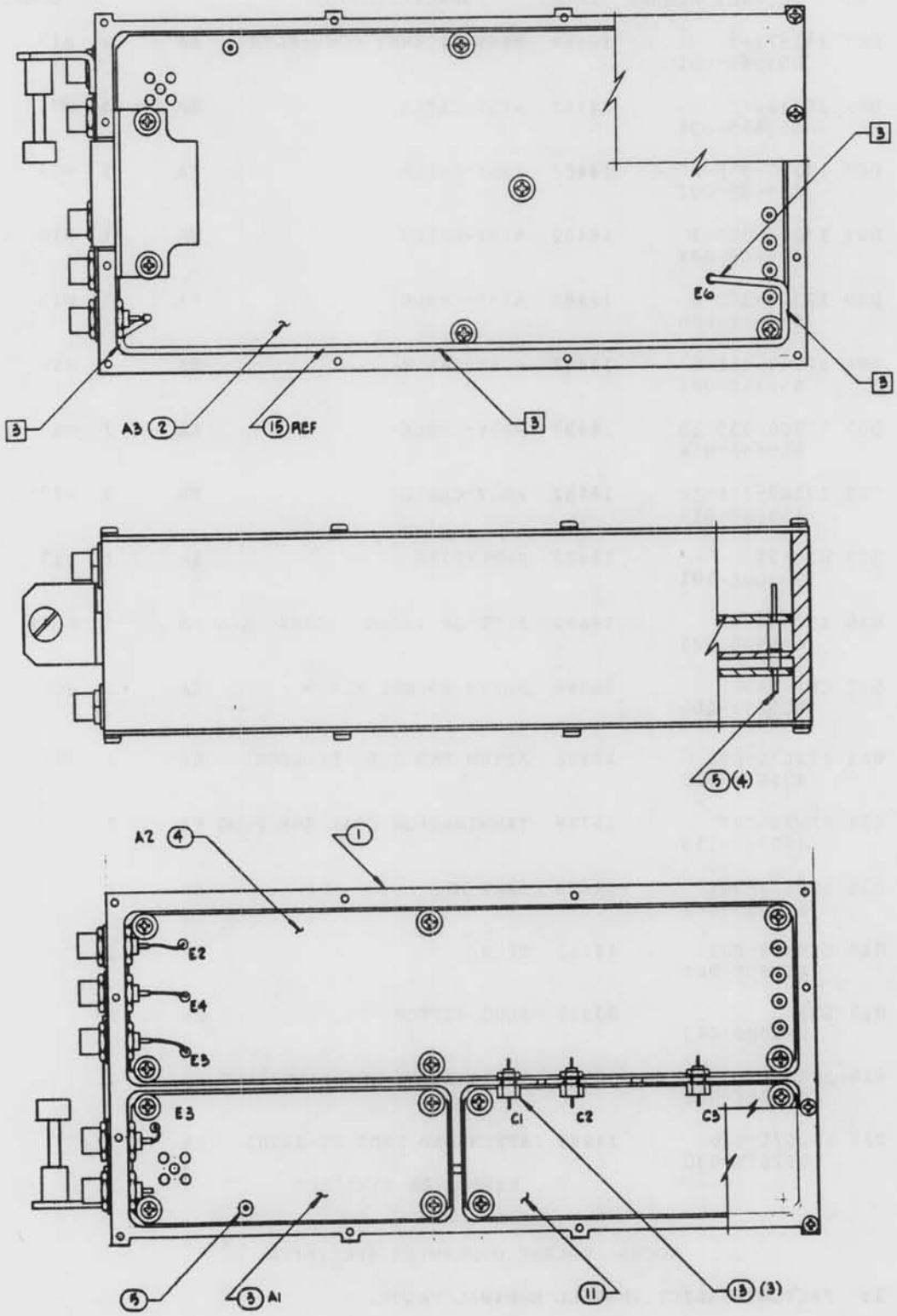
ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
001	796572-1 659569-001	14482	ASSY-21.4MHZ CONV/FLTR	EA	1	A12
002	381106-1 659469-001	14482	ASSY-CABLE	EA	1	W06
003	17300-355-2 659468-002	14482	ASSY-CABLE	EA	1	W09
004	17300-355-3 659468-003	14482	ASSY-CABLE	EA	1	W10
005	17300-355-6 659468-006	14482	ASSY-CABLE	EA	1	W13
006	17300-355-9 659468-009	14482	ASSY-CABLE	EA	1	W16
007	17300-355-10 659468-010	14482	ASSY-CABLE	EA	1	W19
008	17300-355-10 659468-011	14482	ASSY-CABLE	EA	1	W20
009	WJCA77 990006-101	14482	AMPLIFIER	EA	1	A13
010	480903-1 659536-001	14482	FLTR BP 160MHZ 10MHZ SCD	EA	1	FL01
011	CDI-5490 090893-000	30990	ADPTR 90 DEG ELBOW	EA	1	J01
013	632675-020 632675-020	14482	ATTEN PAD 0DB DC-18GHZ	EA	1	J01
014	0SM20020P 090999-119	16179	TERMINATION COAX SMA PLUG	EA	3-	
015	660518-001 660518-001	14482	BRKT MTG	EA	1	
016	660519-001 660519-001	14482	SPCR	EA	1	
017	653 589000-003	83330	PLUG BUTTON	EA	1-	
018	5065 090901-000	30990	ADPTR R-ANG SMA PLUG-PLUG	EA	1	
019	632675-030 632675-030	14482	ATTEN PAD 10DB DC-18GHZ	EA	1	

EXPLOSION FINISHED

NOTES: UNLESS OTHERWISE SPECIFIED

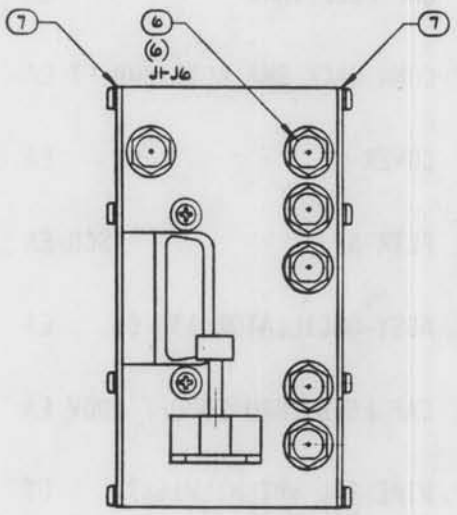
1: FACTORY SELECT.INSTALL NOMINAL VALUE.

Figure 5-23. 21.4 MHz Bandwidth Opt AA Parts List, Part No. 660530
(Sheet 1 of 1)



659569A/1

Figure 5-24. 21.4 MHz Converter/Filter A12 Parts List, Part No. 659569 (Sheet 1 of 3)



1. SOLDER JACKET OF ITEM 15 TO CHASSIS APPROX. POINT AS SHOWN
2. REFERENCE DESIGNATIONS ARE FOR REFERENCE ONLY AND MAY OR MAY NOT APPEAR ON PART
1. SOLDER PER MIL-STD-454 REQUIREMENTS

NOTES: UNLESS OTHERWISE SPECIFIED

659569A/2

Figure 5-24. 21.4 MHz Converter/Filter A12 Parts List, Part No. 659569 (Sheet 2 of 3)

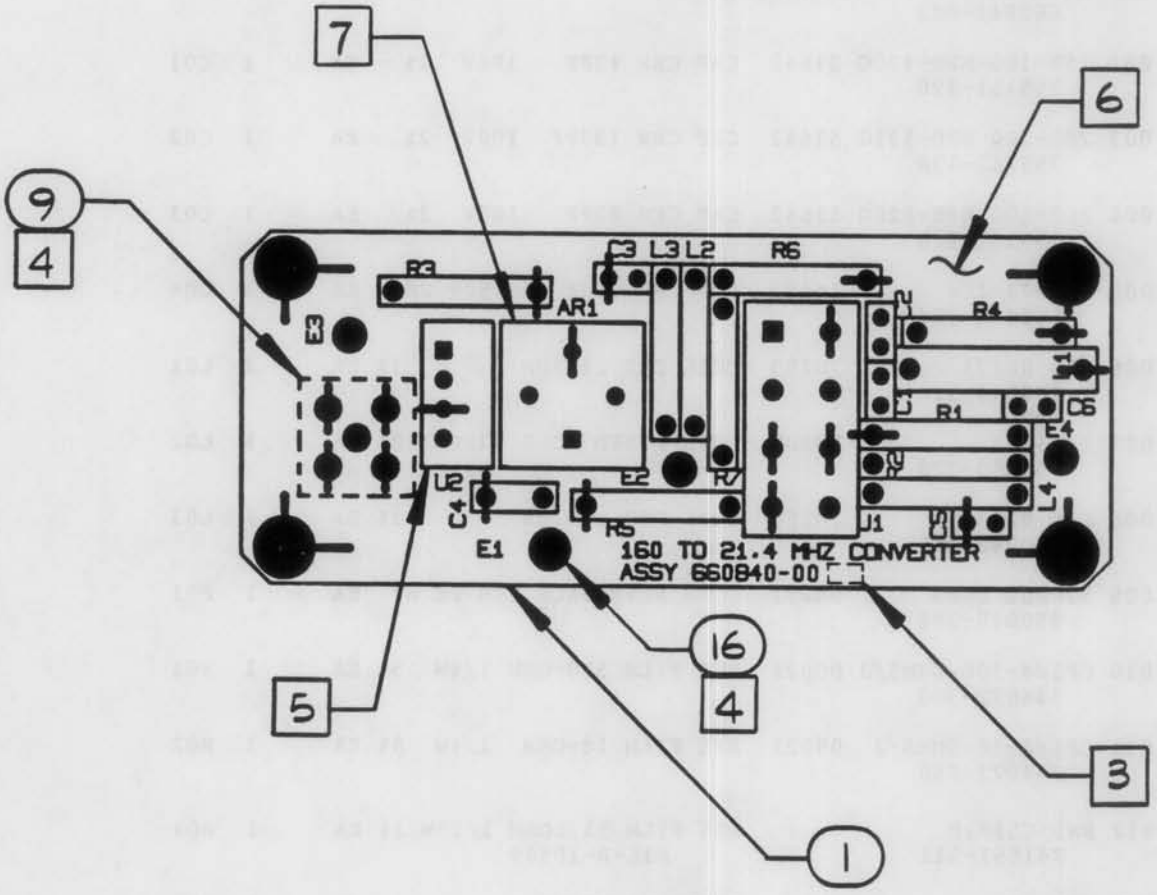
ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS REV. A
001	659570-001 659570-001	14482	CHAS	EA	1	
002	660836-001 660836-001	14482	ASSY-CCA 21.4MHZ IF FLTR	EA	1	A03
003	660840-001 660840-001	14482	ASSY-CCA 160-21.4MHZ CONV	EA	1	A01
004	660832-001 660832-001	14482	ASSY-CCA 21.4 BFO OSC	EA	1	A02
005	859615-1 990018-323	00779	CAP FEED THRU	EA	5	C01-05
006	OSM211 090999-175	16179	CONN JACK SMA RCTP BHD FT	EA	6	J01-06
007	659575-001 659575-001	14482	COVER	EA	2	
009	659538-0XX 659538-0XX	14482	FLTR BP SCD	EA	AR	SEE NOTE 1
011	661534-001 661534-001	14482	ASSY-OSCILLATOR 138.6	EA	1	A04
013	281216-2 659674-002	14482	CAP FEED THRU 1000PF 100V	EA	3	C01-03
014	24AWG-TY-E-9 430240-009		WIRE TFL WHT MILW16878 MIL-W-16878	FT	AR	
015	DA50047 990018-856	64639	CABLE SEMI-RIGID	FT	AR	
016	24AWG-TY-E-2 430240-002		WIRE TFL RED MILW16878 MIL-W-16878	FT	AR	
017	24AWG-TY-E-4 430240-004		WIRE TFL YEL MILW16878 MIL-W-16878	FT	AR	
018	24AWG-TY-E-94 430240-104		WIRE TFL WT/YEL MILW16878 MIL-W-16878	FT	AR	
019	661464 661464	14482	INTERCONN DIAG	EA	REF	

EXPLOSION FINISHED

NOTES: UNLESS OTHERWISE SPECIFIED

1: DETERMINED BY CUSTOMER REQUIREMENT.

Figure 5-24. 21.4 MHz Converter/Filter A12 Parts List, Part No. 659569 (Sheet 3 of 3)



660840

[7] TACK SOLDER CASE OF AR1 TO GROUND PLANE.

[6] GROUND PLANE OMITTED ON DRAWING FOR CLARITY.

[5] BLUE BEAD ON COMPONENT INDICATES PIN 1.

[4] INSTALL ITEMS 9 AND 16 FROM PWB SIDE.

[3] MARK DASH NO. PER MIL-STD-130 APPROXIMATELY WHERE SHOWN USING .12 HIGH CHARACTERS WITH WHITE INK COLOR NO. 17875 PER MIL-STD-595.

2. OBSERVE POLARITY OF CAPACITORS AND SEMICONDUCTOR DEVICES.

1. SOLDER PER MIL-STD-454.

NOTES: UNLESS OTHERWISE SPECIFIED

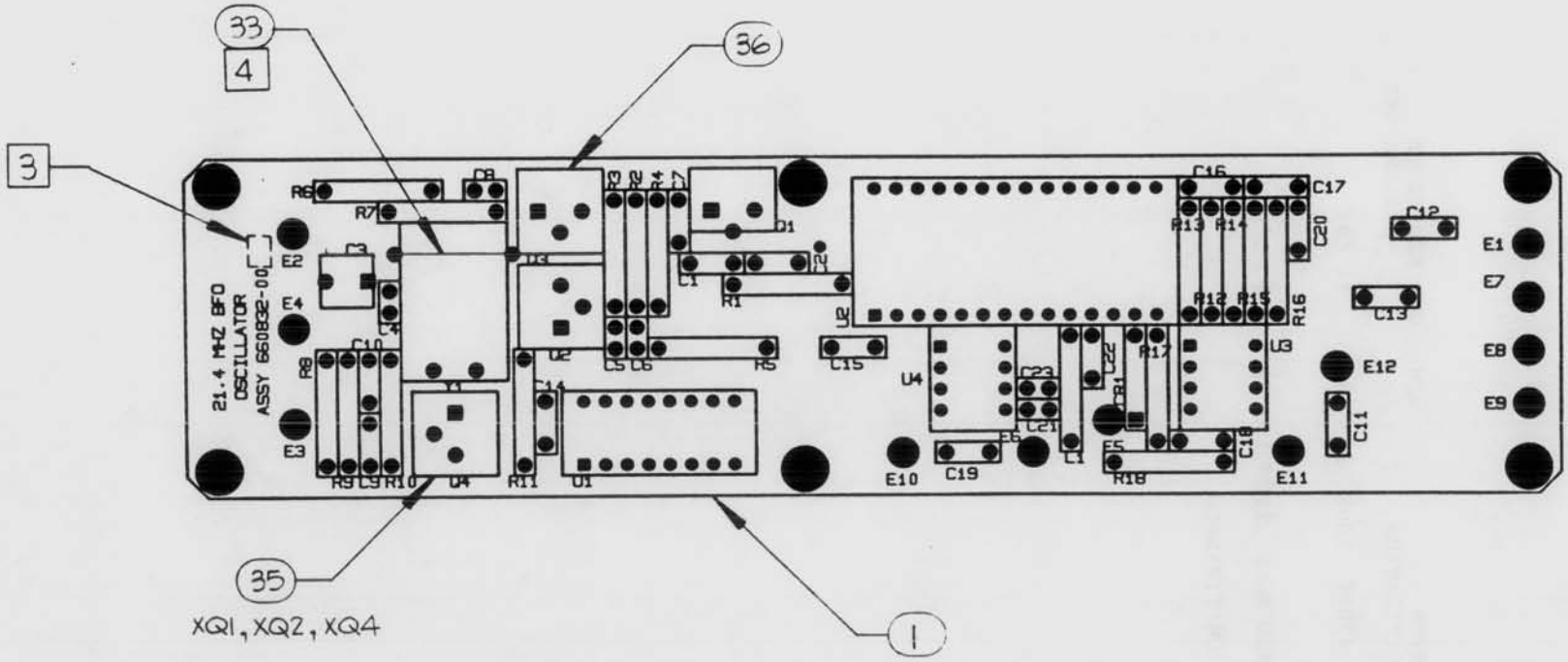
Figure 5-25. 160 to 21.4 MHz Converter CCA A12A1 Parts List, Part No. 660840 (Sheet 1 of 3)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS	
001	660841-001 660841-001	14482	PWB	EA	1		
002	150-100-NP0-420G 759161-420	51642	CAP CER 43PF 100V 2%	EA	1	C01	
003	200-100-NP0-131G 759162-130	51642	CAP CER 130PF 100V 2%	EA	1	C02	
004	200-100-NP0-820G 759161-820	51642	CAP CER 82PF 100V 2%	EA	1	C03	
005	660073-104 660073-104	14482	CAP CER .1UF 50V 20%	EA	1	C04	
006	L10-0R121 760040-121	7W259	COIL FXD .121UH 1%	EA	1	L01	
007	1025-04 760040-220	99800	COIL FIXED MOLD .22UH 10%	EA	1	L02	
008	L10-0R082 760040-082	7W259	COIL FXD .082UH 1%	EA	1	L03	
009	52-051-0000 990018-208	98291	CONN RCTP JACK STR PC MT	EA	1	P01	
010	CF1/4-300-0HMS/J 744072-300	09021	RES FILM 300-OHM 1/4W 5%	EA	1	R01	
011	CF1/4-18-0HMS/J 744071-180	09021	RES FILM 18-OHM 1/4W 5%	EA	1	R02	
012	RN55C51R1F 741551-511		RES FILM 51.1OHM 1/10W 1% MIL-R-10509	EA	1	R04	
013	SRA-1MH 990018-637	15542	MIXER LO RF/IF	EA	1	U01	
014	WJA82 990009-334	14482	AMPL	EA	1	AR01	
015	TSC-2-1 990018-624	15542	PWR SPLTR 1-400MHZ 2WAY	EA	1	U02	
016	450-3286-01-03 794100-006	71279	JACK PC THRU-HOLE FOR .04	EA	1	E01	
017	CF1/4-1K/J 744073-100	09021	RES FILM 1K 1/4W 5%	EA	1	R03	
026	660843 660843		SCHEM DIAG	EA	REF		
027	CF1/4-62-0HMS/J 744071-620	09021	RES FILM 62-OHM 1/4W 5%	EA	1	R07	SEE NOTE 1
028	CF1/4-100-0HMS/J 744072-100	09021	RES FILM 100-OHM 1/4W 5%	EA	2	R05 06	SEE NOTE 1
029	100-100-NP0-150G 759161-150	51642	CAP CER 15PF 100V 2%	EA	1	C06	

Figure 5-25. 160 to 21.4 MHz Converter CCA A12A1 Parts List, Part No. 660840 (Sheet 2 of 3)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
030	150-100-NP0-471G 759162-470	51642	CAP CER 470PF 100V 2%	EA	1	C05
031	1025-00 760040-150	99800	COIL FIXED MOLD .15UH 10%	EA	1	L04
			EXPLOSION FINISHED			

Figure 5-25. 160 to 21.4 MHz Converter CCA A12A1 Parts List, Part No. 660840 (Sheet 3 of 3)



5 INSTALL ITEM 34 FROM PWB SIDE.

4 TIE Y1 DOWN USING ITEM 33 AND TACK SOLDER TO CASE.

3 MARK DASH NO. PER MIL-STD-130 APPROXIMATELY WHERE SHOWN USING .12 HIGH CHARACTERS WITH WHITE INK COLOR NO. 17875 PER FED-STD-595.

2. OBSERVE POLARITY OF CAPACITORS AND SEMICONDUCTOR DEVICES.

1. SOLDER PER MIL-STD-454.

NOTES: UNLESS OTHERWISE SPECIFIED

660832

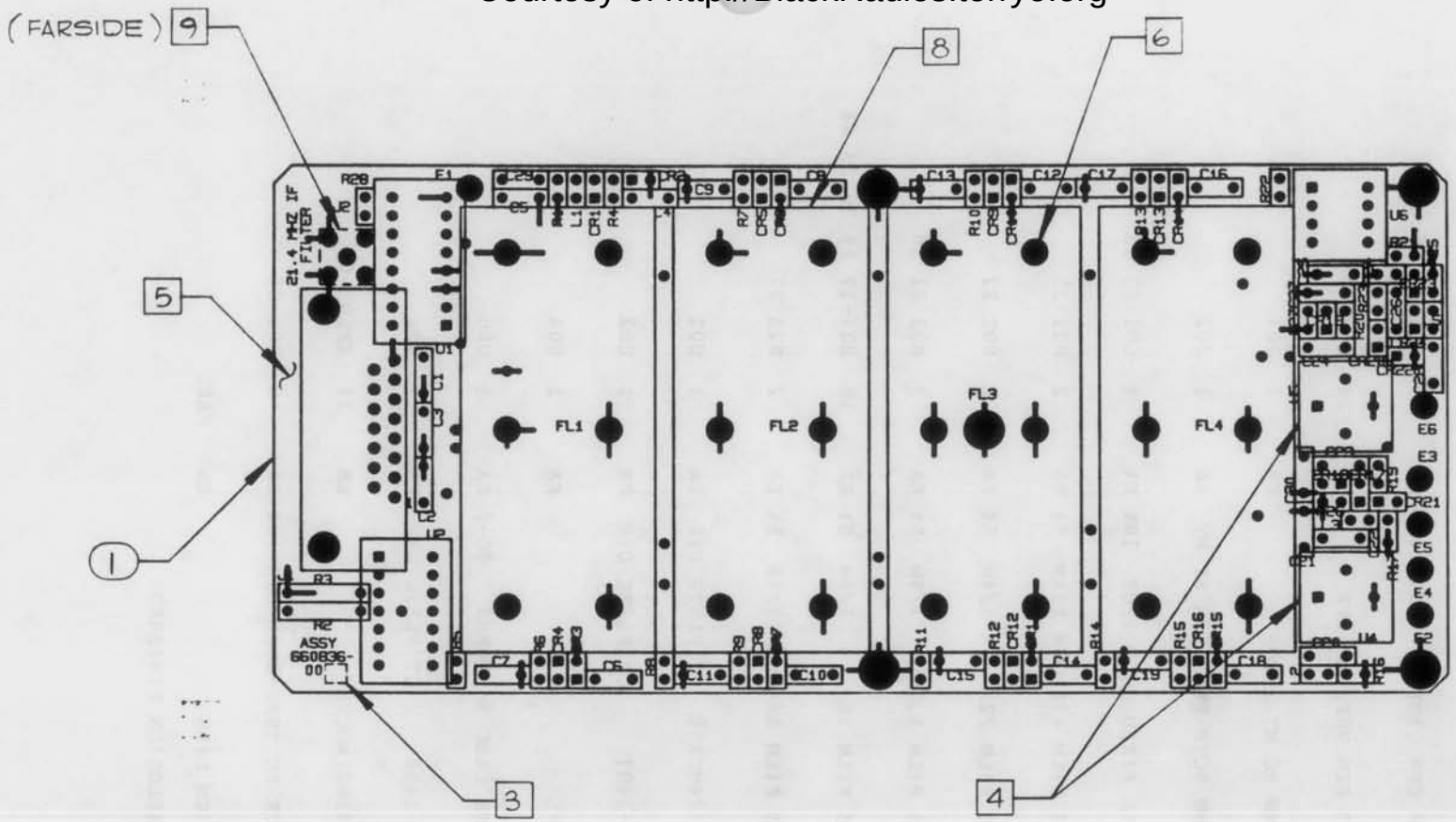
Figure 5-26. 21.4 MHz BFO Oscillator CCA A12A2 Parts List, Part No. 660832 (Sheet 1 of 3)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
001	660833-001 660833-001	14482	PWB	EA	1	
002	660073-474 660073-474	14482	CAP CER .47UF 50V 20%	EA	1	C01
003	660073-104 660073-104	14482	CAP CER .1UF 50V 20%	EA	6	C02 07 14 15 19 22
004	518-000A5-25 990018-360	59660	CAP VAR CER 5-25PF 100V	EA	1	C03
005	200-100-NP0-750G 759161-750	51642	CAP CER 75PF 100V 2%	EA	1	C04
006	200-100-NP0-101G 759162-100	51642	CAP CER 100PF 100V 2%	EA	1	C05
007	200-100-NP0-680G 759161-680	51642	CAP CER 68PF 100V 2%	EA	1	C06
008	8121-100-X7R0-* 990018-361	59660	CAP DISC 1000PF 100V*102K	EA	2	C08 23
009	100-100-NP0-150G 759161-150	51642	CAP CER 15PF 100V 2%	EA	1	C21
010	660073-103 660073-103	14482	CAP CER .01UF 50V 20%	EA	6	C09-13 16 17
011	CK06BX104K 751155-100		CAP CER .1UF 100V 10% MIL-C-11015	EA	2	C18 20
013	1N4449 775000-001	80131	DIO HI COND HS SW 75PPV	EA	1	CR01
014	L10-0R082 760040-082	7W259	COIL FXD .082UH 1%	EA	1	L01
015	2N4401 780000-022		XSTR NPN GEN PURPOSE	EA	1	Q01
016	2N2369 780000-026	80131	XSTR NPN LOW PWR HI-SPD	EA	2	Q02 04
017	2N3866 059090-000		XSTR NPN HIGH PWR TO-39	EA	1	Q03
018	CF1/4-4.7K/J 744073-470	09021	RES FILM 4.7K 1/4W 5%	EA	4	R01-03 10
019	CF1/4-330-OHMS/J 744072-330	09021	RES FILM 330-OHM 1/4W 5%	EA	1	R11
020	CF1/4-1K/J 744073-100	09021	RES FILM 1K 1/4W 5%	EA	2	R05 09
021	CF1/4-51-OHMS/J 744071-510	09021	RES FILM 51-OHM 1/4W 5%	EA	2	R07 08
022	CF1/4-3.3K/J 744073-330	09021	RES FILM 3.3K 1/4W 5%	EA	4	R12-15

Figure 5-26. 21.4 MHz BFO Oscillator CCA A12A2 Parts List, Part No. 660832 (Sheet 2 of 3)

ITEM NO	MFR PART NUMBER WJ PART NUMBER	CODE IDENT	DESCRIPTION SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
023	CF1/4-330K/J 744075-330	09021	RES FILM 330K 1/4W 5%	EA	2	R16 17
024	CF1/4-10K/J 744074-100	09021	RES FILM 10K 1/4W 5%	EA	1	R18
025	CF1/4-680-OHMS/J 744075-680	09021	RES FILM 680-OHM 1/4W 5%	EA	1	R04
026	CF1/4-10-OHMS/J 744071-100	09021	RES FILM 10-OHM 1/4W 5%	EA	1	R06
027	627607-683 627607-683	14482	IC-74LS390 CT PLSTC DIP	EA	1	U01
028	627601-260 627601-260	14482	IC-145152 IT PLSTC DIP	EA	1	U02
029	627601-232 627601-232	14482	IC-1007 CT PLSTC DIP	EA	1	U03
030	627601-379 627601-379	14482	IC-12015 CT PLSTC DIP	EA	1	U04
032	660100-001 660100-001	14482	XTAL QUARTZ 21.4MHZ SCD	EA	1	Y01
033	22AWG-QQW343 442222-000		WIRE BUS SOLID TINNED CU QQ-W-343	FT	AR	
034	450-3286-01-03 794100-006	71279	JACK PC THRU-HOLE FOR .04	EA	4	E01 07-09
035	10109DAP 702023-003	07047	INSULATOR PAD TO-18	EA	3	XQ01 02 04
036	10027DAP 702023-001	07047	INSULATOR PAD TO-5	EA	1	XQ03
039	660835 660835	14482	SCHEM DIAG	EA	REF	
			EXPLOSION FINISHED			

Figure 5-26. 21.4 MHz BFO Oscillator CCA A12A2 Parts List, Part No. 660832 (Sheet 3 of 3)



9 INSTALL J2 ON PWB SIDE OF BOARD.

8 FL1-FL4 SHOWN FOR REFERENCE ONLY. TO BE INSTALLED AT NEXT LEVEL OF ASSY.

7 INSTALL ITEM 18 5 PLACES FROM PWB SIDE AND SOLDER.

6 INSTALL ITEM 17 24 PLACES FROM ASSY SIDE AND SOLDER.

5 GROUND PLANE ON DRAWING OMITTED FOR CLARITY.

4 TACK SOLDER CASE OF U4 & U5 TO GROUND PLANE.

3 MARK DASH NO. PER MIL-STD-130 APPROXIMATELY WHERE SHOWN
USING .12 HIGH CHARACTERS WITH WHITE INK COLOR NO.17875 PER MIL-STD-595.

2. OBSERVE POLARITY OF CAPACITORS AND SEMICONDUCTOR DEVICES.

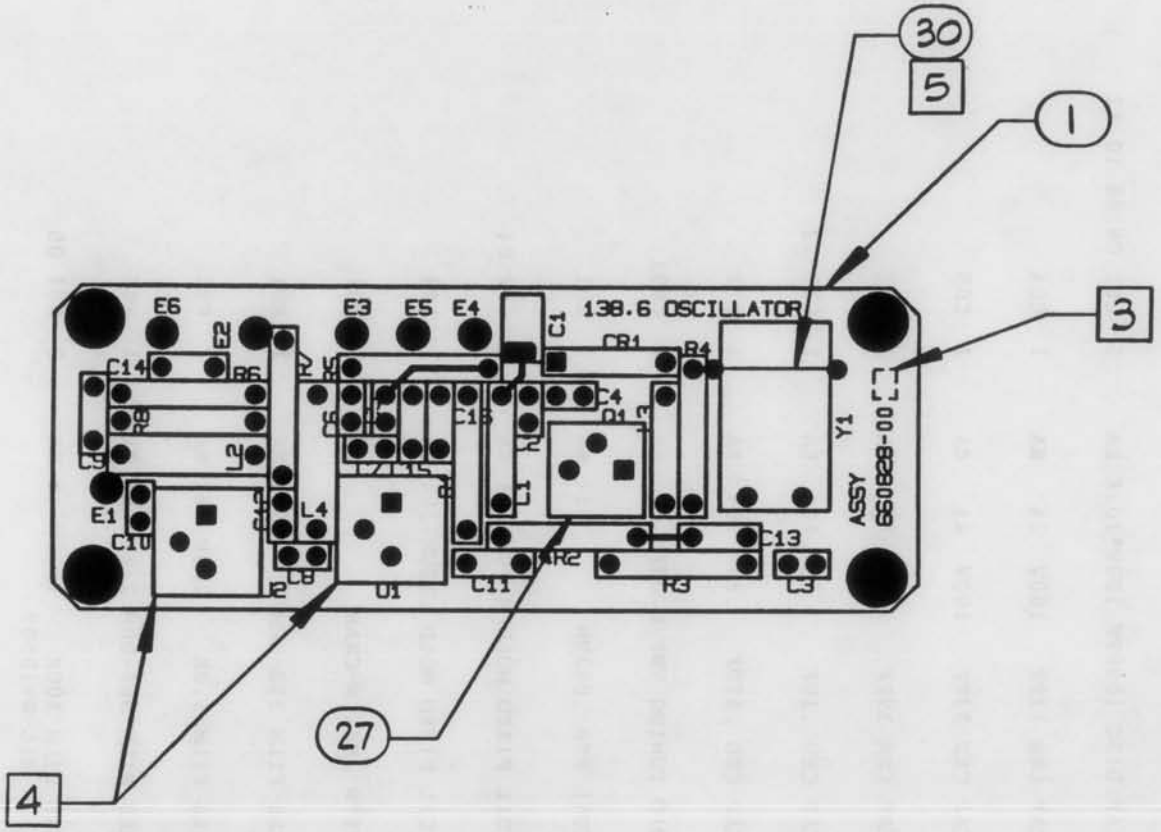
1. SOLDER PER MIL-STD-454.

NOTES: UNLESS OTHERWISE SPECIFIED

660836 Figure 5-27. 21.4 MHz IF Filter CCA A12A3 Parts List, Part No. 660836 (Sheet 1 of 2)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
001	660837-001 660837-001	14482	PWB	EA	1	
002	660073-104 660073-104	14482	CAP CER .1UF 50V 20%	EA	30	C01-30
003	5082-3188 990018-292	28480	DIO PIN VHF/UHF 1PF	EA	24	CR01-24
004	56-714-005 990018-317	33095	CONN PC MT 15POS	EA	1	J01
005	52-052-0000 990018-353	98291	CONN RCTP PLUG STR PC MT	EA	1	J02
006	1025-52 760042-220	99800	COIL FIXED MOLD 22UH 10%	EA	4	L01-03 05
007	CF1/4-470-OHMS/J 744072-470	09021	RES FILM 470-OHM 1/4W 5%	EA	2	R01 25
008	CF1/4-22K/J 744074-220	09021	RES FILM 22K 1/4W 5%	EA	2	R02 22
009	CF1/4-4.7K/J 744073-470	09021	RES FILM 4.7K 1/4W 5%	EA	3	R03 21 28
010	CF1/4-1K/J 744073-100	09021	RES FILM 1K 1/4W 5%	EA	18	R04-17 19 20 23 24
011	CF1/4-56-OHMS/J 744071-560	09021	RES FILM 56-OHM 1/4W 5%	EA	2	R26 27
012	627607-359 627607-359	14482	IC-74HC138 CT PLSTC DIP	EA	1	U01
013	627603-136 627603-136	14482	IC-3403 CT PLSTC DIP	EA	1	U02
014	WJA87 990009-315	14482	AMPL	EA	1	U04
015	WJA72 990009-246	14482	AMPL CASC 5-500MHZ TO-8	EA	1	U05
016	627601-063 627601-063	14482	IC-1458 CT PLSTC DIP	EA	1	U06
017	50865-3 588300-001	00779	SPRING SOCKET	EA	24	XFL01-04
018	450-3286-01-03 794100-006	71279	JACK PC THRU-HOLE FOR .04	EA	5	E01-05
026	660839 660839		SCHEM DIAG	EA	REF	
			EXPLOSION FINISHED			

Figure 5-27. 21.4 MHz IF Filter CCA A12A3 Parts List, Part No. 660836 (Sheet 2 of 2)



5 TIE Y1 DOWN USING ITEM 30 & TACK SOLDER TO CASE.

4 SOLDER CASE OF U1 & U2 TO GND PLANE.

3 MARK DASH NO. PER MIL-STD-130 APPROXIMATELY WHERE SHOWN USING .12 HIGH CHARACTERS WITH WHITE INK COLOR NO. 17875 PER FED-STD-595.

2. OBSERVE POLARITY OF CAPACITORS AND SEMICONDUCTOR DEVICES.

1. SOLDER PER MIL-STD-454.

NOTES: UNLESS OTHERWISE SPECIFIED

660828

Figure 5-28. 138.6 MHz Oscillator A12A4 Parts List, Part No. 660828 (Sheet 1 of 3)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
001	660829-001 660829-001	14482	PWB	EA	1	
002	P5F 990019-108	18736	CAP TRIM .6-4.5PF MIL-C-14409D	EA	1	C01
003	100-100-NP0-150G 759161-150	51642	CAP CER 15PF 100V 2%	EA	1	C02
004	8121-100-X7R0-* 990018-361	59660	CAP DISC 1000PF 100V*102K	EA	5	C03 06 08 10 12
005	100-100-NP0-120G 759161-120	51642	CAP CER 12PF 100V 2%	EA	1	C04
006	150-100-NP0-330G 759161-330	51642	CAP CER 33PF 100V 2%	EA	1	C05
007	150-100-NP0-390G 759161-390	51642	CAP CER 39PF 100V 2%	EA	1	C07
008	660073-104 660073-104	14482	CAP CER .1UF 50V 20%	EA	2	C09 13
009	660073-474 660073-474	14482	CAP CER .47UF 50V 20%	EA	1	C11
011	U11-3102 990018-366	85033	DIO TUNING VHF & UHF	EA	1	CR01
012	L10-0R082 760040-082	7W259	COIL FXD .082UH 1%	EA	1	L01
013	1025-36 760041-470	99800	COIL FIXED MOLD 4.7UH 10%	EA	2	L02 04
014	1025-96 760040-120	99800	COIL FIXED MOLD .12UH 10%	EA	1	L03
015	U310 990018-367	17856	XSTR JFET N-CHAN	EA	1	Q01
017	CF1/4-330-0HMS/J 744072-330	09021	RES FILM 330-OHM 1/4W 5%	EA	1	R01
018	CF1/4-1.2K/J 744073-120	09021	RES FILM 1.2K 1/4W 5%	EA	1	R02
019	CF1/4-560-0HMS/J 744072-560	09021	RES FILM 560-OHM 1/4W 5%	EA	1	R03
020	RN55C1003F 741555-100		RES FILM 100K 1/10W 1% MIL-R-10509	EA	2	R04 05
021	CF1/4-68-0HMS/J 744071-680	09021	RES FILM 68-OHM 1/4W 5%	EA	1	R06
022	CF1/4-2K/J 744073-200	09021	RES FILM 2K 1/4W 5%	EA	1	R07
023	CF1/4-8.2-0HMS/J 744070-820	09021	RES FILM 8.2-OHM 1/4W 5%	EA	1	R08

Figure 5-28. 138.6 MHz Oscillator A12A4 Parts List, Part No. 660828
(Sheet 2 of 3)

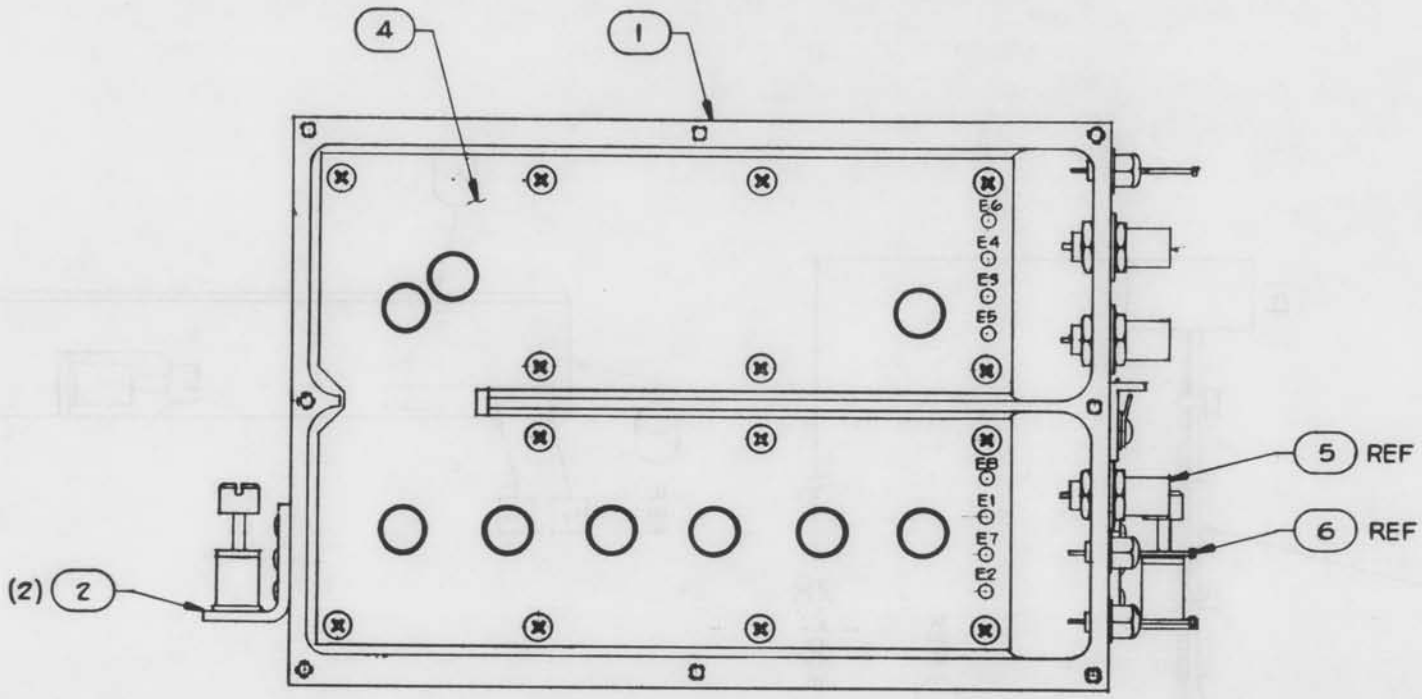
ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
025	627602-027 627602-027	14482	IC-220 CT MET CAN	EA	1	U01
026	627602-028 627602-028	14482	IC-230 CT MET CAN	EA	1	U02
027	10109DAP 702023-003	07047	INSULATOR PAD TO-18	EA	1	XQ01
028	659918-007 659918-007	14482	XTAL QUARTZ 138.6MHZ SCD	EA	1	Y01
030	22AWG-QQW343 442222-000		WIRE BUS SOLID TINNED CU QQ-W-343	FT	AR	
032	660831 660831		SCHEM DIAG	EA	REF	
033	660073-103 660073-103	14482	CAP CER .01UF 50V 20%	EA	3	C14-16
			EXPLOSION FINISHED			

Figure 5-28. 138.6 MHz Oscillator A12A4 Parts List, Part No. 660828 (Sheet 3 of 3)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
001	660743-001 660743-001	14482	ASSY-LOG AMPL	EA	1	A14
002	660194-002 660194-002	14482	ASSY-CABLE	EA	1	
003	660194-001 660194-001	14482	ASSY-CABLE	EA	1-	
004	17300-355-12 659468-012	14482	ASSY-CABLE	EA	1	W02
005	17300-355-13 659468-013	14482	ASSY-CABLE	EA	1	W09
006	17300-355-14 659468-014	14482	ASSY-CABLE	EA	1	W10
007	17300-355-15 659468-015	14482	ASSY-CABLE	EA	1	W11
008	17300-355-1 659468-001	14482	ASSY-CABLE	EA	1-	W02
009	17300-355-2 659468-002	14482	ASSY-CABLE	EA	1-	W09
010	17300-355-3 659468-003	14482	ASSY-CABLE	EA	1-	W10
011	17300-355-4 659468-004	14482	ASSY-CABLE	EA	1-	W11
012	OSM20020P 090999-119	16179	TERMINATION COAX SMA PLUG	EA	1-	
013	17300-355-5 659468-005	14482	ASSY-CABLE	EA	1	W12
014	17300-355-8 659468-008	14482	ASSY-CABLE	EA	1	W15

EXPLOSION FINISHED

Figure 5-29. Option AB Log Video Parts List, Part No. 660531
(Sheet 1 of 1)



660743A/1

4. MARK DASH NUMBER.

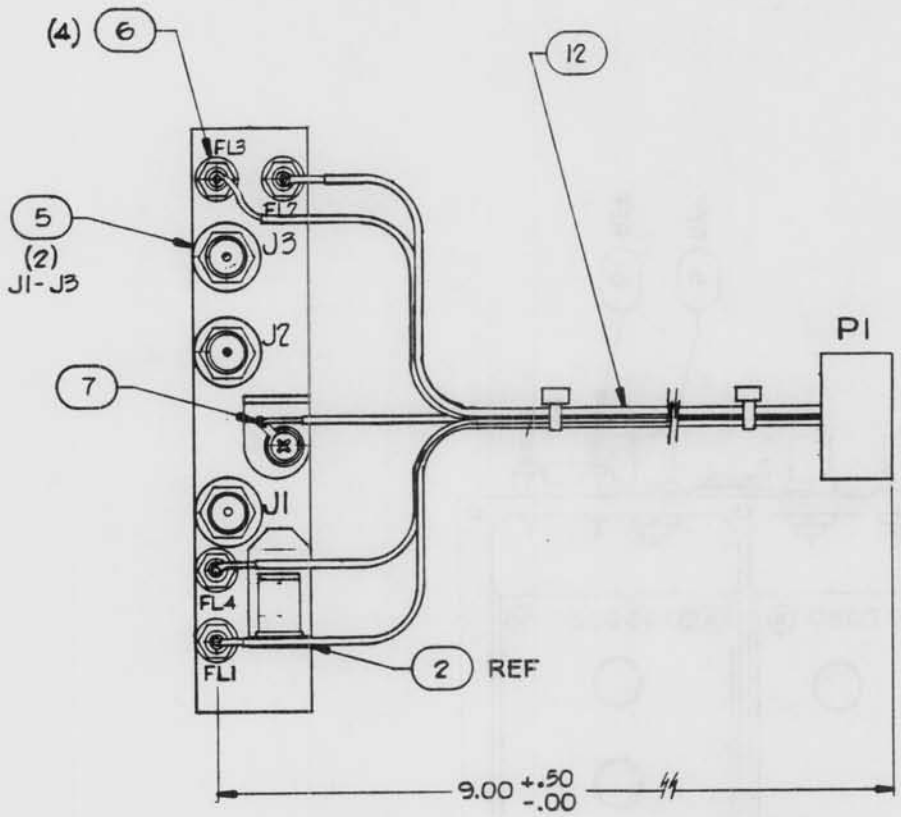
3 MARK REF DESIGNATIONS & NOMENCLATURE APPROXIMATELY WHERE SHOWN USING .12 HIGH CHARACTERS WITH BLACK EPOXY INK COLOR NO. 17038 PER FED-STD-595 AFTER FINISH

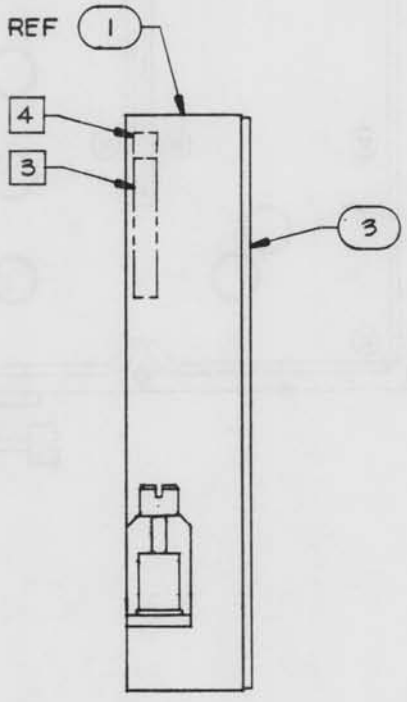
2. REFERENCE DESIGNATIONS ARE FOR REFERENCE ONLY AND MAY OR MAY NOT APPEAR ON PART

1. SOLDER PER MIL-STD-454 REQUIREMENT

NOTES: UNLESS OTHERWISE SPECIFIED

Figure 5-30. Log Amplifier A14 Parts List, Part No. 660743 (Sheet 1 of 3)





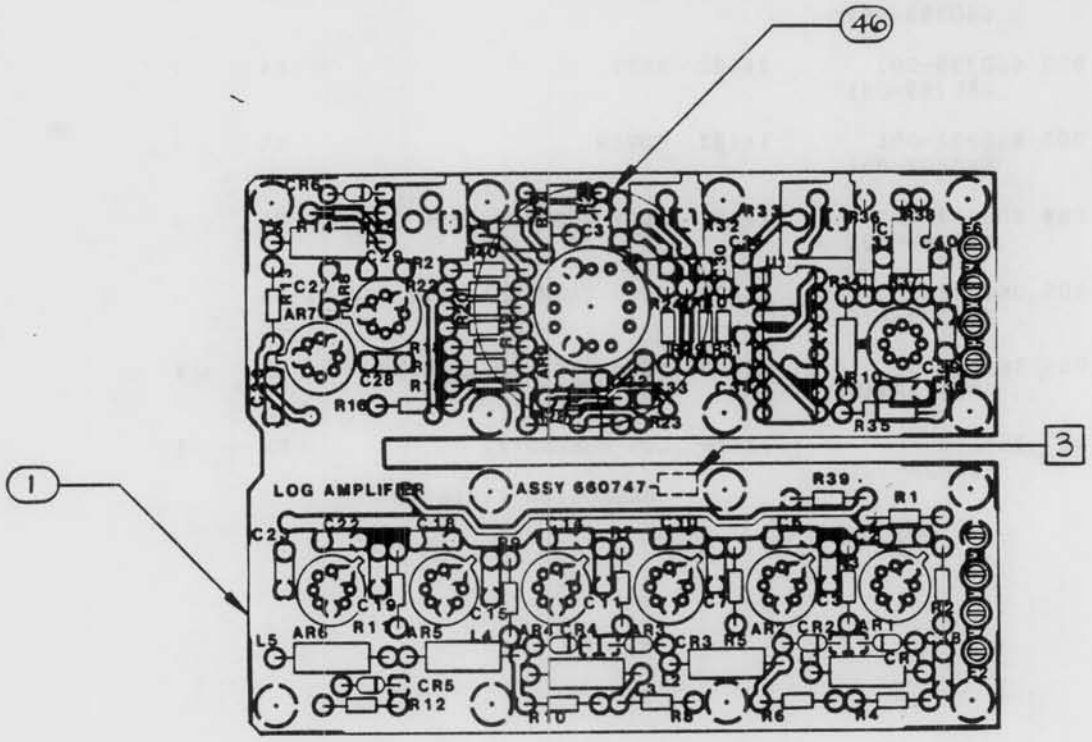
WIRE LIST				
ITEM NO.	FROM	TO	WIRE COLOR	REMARKS
9	E6	J3	WHITE	OUT
11	E4	FL3	WHITE/YELLOW	-15V
10	E3	FL2	YELLOW	+15V
9	E5	J2	WHITE	LIM IF
9	E1	J1	WHITE	IN
9	E7	FL4	WHITE	CONTROL
8	E2	FL1	RED	+5V
12	P1-9	FL3	WHITE/YELLOW	-15V
12	P1-5	FL2	YELLOW	+15V
12	P1-4	GND	BLACK	GND
12	P1-2	FL4	RED	CONTROL
12	P1-1	FL1	WHITE	+5V

660743A/2

Figure 5-30. Log Amplifier A14 Parts List, Part No. 660743
(Sheet 2 of 3)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
001	660798-001 660798-001	14482	CHAS	EA	1	
002	660799-001 660799-001	14482	BRKT	EA	2	
003	660802-001 660802-001	14482	COVER	EA	1	
004	660747-001 660747-001	14482	ASSY-CCA LOG AMPL	EA	1	
005	0SM211 090999-175	16179	CONN JACK SMA RCTP BHD FT	EA	3	
006	SB3B1-152 990019-309	59942	FLTR F/T 1500PF 200V	EA	4	
007	38-200 510010-101	73734	LUG SOLDER #2	EA	1	
			EXPLOSION FINISHED			

Figure 5-30. Log Amplifier A14 Parts List, Part No. 660743
(Sheet 3 of 3)



660747/1

4 ALL CHIP CAPACITORS MOUNTED ON PWB SIDE

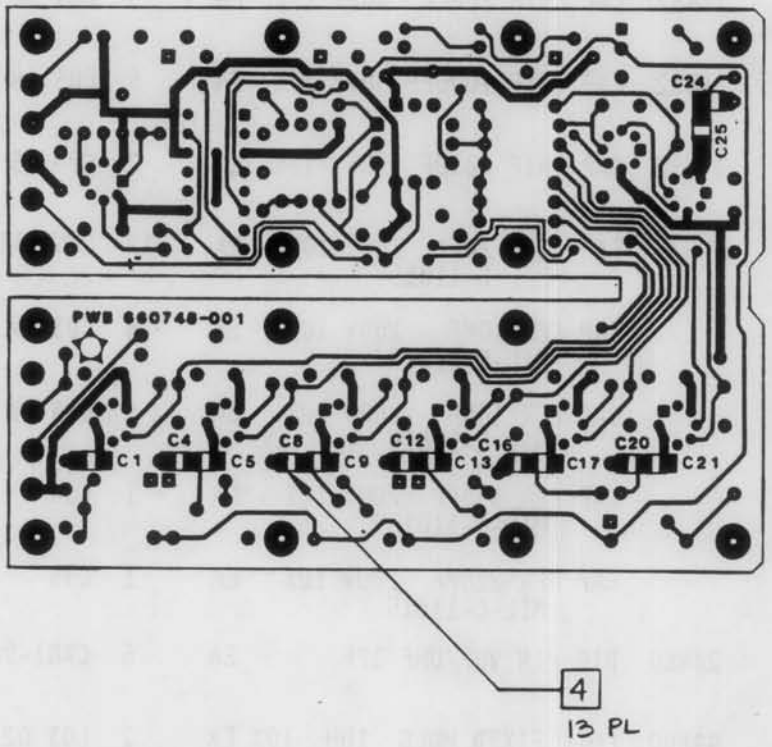
3 MARK DASH NUMBER PER MIL-STD-130 APPROXIMATELY WHERE SHOWN USING .12 HIGH CHARACTERS WITH BLACK INK COLOR NO 17038 PER FED-STD-595.

2. OBSERVE POLARITY OF CAPACITORS AND SEMICONDUCTOR DEVICES.

1. SOLDER PER MIL-STD-454

NOTES: UNLESS OTHERWISE SPECIFIED

Figure 5-31. Log Amplifier A14A1 Parts List, Part No. 660747
(Sheet 1 of 5)



660747/2

Figure 5-31. Log Amplifier A14A1 Parts List, Part No. 660747
(Sheet 2 of 5)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS	REV. A
001	660748-001 660748-001	14482	PWB	EA	1		
002	660750 660750		SCHEM DIAG	EA	REF		
004	652540-005 652540-005	14482	CAP CHIP 5PF 50V 2%	EA	1	C01	
005	652540-015 652540-015	14482	CAP CHIP 100PF 50V 10%	EA	5	C04 08 12 16 20	
006	652540-022 652540-022	14482	CAP CHIP 1000PF 50V 10%	EA	5	C05 09 13 17 21	
007	652540-033 652540-033	14482	CAP CHIP .01UF 50V 10%	EA	2	C24 25	
009	CK05BX104K 750105-100		CAP CER .1UF 50V 10% MIL-C-11015	EA	17	C02 06 10 14 18 22 26 28 30-33 36-40	
010	CK06BX100K 751201-100		CAP CER 10PF 200V 10% MIL-C-11015	EA	4	C03 07 11 15	
011	CK05BX150K 750201-150		CAP CER 15PF 200V 10% MIL-C-11015	EA	4	C19 23 27 29	
012	CK05BX391K 750202-390		CAP CER 390PF 200V 10% MIL-C-11015	EA	1	C34	
013	CK05BX221K 750202-220		CAP CER 220PF 200V 10% MIL-C-11015	EA	1	C35	
015	5082-3188 990018-292	28480	DIO PIN VHF/UHF 1PF	EA	6	CR01-06	
017	1025-94 760040-100	99800	COIL FIXED MOLD .1UH 10%	EA	2	L01 02	
018	1025-00 760040-150	99800	COIL FIXED MOLD .15UH 10%	EA	3	L03-05	
019	1025-02 760040-180	99800	COIL FIXED MOLD .18UH 10%	EA	1	L06	
021	RCR056510JS 740051-510		RES CMPSN 51-OHM 1/8W 5% MIL-R-39008	EA	1	R01	
022	RCR056330JS 740051-330		RES CMPSN 33-OHM 1/8W 5% MIL-R-39008	EA	1	R02	
023	RCR056151JS 740052-150		RES CMPSN 150-OHM 1/8W 5% MIL-R-39008	EA	6	R03 05 07 09 11 13	
024	RCR056472JS 740053-470		RES CMPSN 4.7K 1/8W 5% MIL-R-39008	EA	6	R04 06 08 10 12 14	

Figure 5-31. Log Amplifier A14A1 Parts List, Part No. 660747
(Sheet 3 of 5)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
025	RCR056152JS 740053-150		RES CMPSN 1.5K 1/8W 5% EA MIL-R-39008	EA	1	R27
026	RN55C3741F 990019-158		RES FILM 3.74K 1/10W 1% EA MIL-R-10509	EA	1	R23
027	RCR056101JS 740052-100		RES CMPSN 100-OHM 1/8W 5% EA MIL-R-39008	EA	3	R28 30 31
028	RCR056202JS 740053-200		RES CMPSN 2K 1/8W 5% EA MIL-R-39008	EA	1	R26
029	RCR056201JS 990019-159		RES CMPSN 200-OHM 1/8W 5% EA MIL-R-39008	EA	1	R29
030	RCR076102JS 740073-100		RES CMPSN 1K 1/4W 5% EA MIL-R-39008	EA	1	R34
031	RCR076101JS 740072-100		RES CMPSN 100-OHM 1/4W 5% EA MIL-R-39008	EA	2	R35 37
032	RCR076103JS 740074-100		RES CMPSN 10K 1/4W 5% EA MIL-R-39008	EA	1	R36
033	RCR076470JS 740071-470		RES CMPSN 47-OHM 1/4W 5% EA MIL-R-39008	EA	1	R38
034	RCR056392JS 990019-160		RES CMPSN 3.9K 1/8W 5% EA MIL-R-39008	EA	1	R39
036	3292P-1-103 990019-140	32997	RES VAR SCR ADJ 10K	EA	1	R25
037	3292P-1-102 990019-141	32997	RES VAR SCR ADJ 1K	EA	2	R32 33
038	RN55C3011F 741553-301		RES FILM 3.01K 1/10W 1% EA MIL-R-10509	EA	1	R40
039	SL1521CB 990019-148	52648	AMPL	EA	8	AR01-08

Figure 5-31. Log Amplifier A14A1 Parts List, Part No. 660747
(Sheet 4 of 5)

ITEM NO	MFR PART NUMBER / WJ PART NUMBER	CODE IDENT	DESCRIPTION / SPECIFICATION	U/M	QTY	REFERENCE DESIGNATORS
040	CLC201A1 990019-149	62839	AMPL	EA	1	AR09
041	HA2-5002-5 990019-364	34371	AMPL TO-5	EA	1	AR10
043	627603-235 627603-235	14482	IC-390 CT PLSTC DIP	EA	1	U01
046	TXBF2-050-033B 790010-008	98978	HEATSINK	EA	1	REF AR9
047	RCR076220JS 740071-220		RES CMPSN 22-OHM 1/4W 5% MIL-R-39008	EA	1	R24
048	RN55C1501F 741553-150		RES FILM 1.5K 1/10W 1% MIL-R-10509	EA	8	R15-22
			EXPLOSION FINISHED			

Figure 5-31. Log Amplifier A14A1 Parts List, Part No. 660747
(Sheet 5 of 5)

Table 5-1. List of Manufacturers' Codes

Code	Manufacturer
00681	Catalyst Research Corp. Division of Mine Safety Appliances Company 1421 Clarkview Road Baltimore, MD 21209-2103
00779	AMP Inc. P.O. Box 3608 Harrisburg, PA 17105
01121	Allen-Bradley Company 1301 South Second Street Milwaukee, WI 53204
05245	Corcom Inc. 1600 Winchester Road Libertyville, IL 60048-1267
06540	Mite Corporation Amatom Electronic Hardware Division 446 Blake Street New Haven, CT 06515
06776	Robinson Nugent Inc. 800 East Eighth Street P.O. Box 1208 New Albany, IN 47150-3264
07047	The Ross Milton Company 511 Second Street Pike Southampton, PA 18966
09021	Airco Inc. Airco Electronics Bradford, PA
09353	C&K Components Inc. 103 Morse Street Watertown, MA 02172
14674	Corning Glass Works Houghton Park Corning, NY 14830
15542	Mini-Circuits Laboratory Division of Scientific Components Corporation 2625 East 14th Street Brooklyn, NY 11235
15818	Teledyne Semiconductor Teledyne Inc. Company 1300 Terra Bella Avenue Mountain View, CA 94043-1836
16059	Devcon Corporation 61 Endicott Street Danvers, MA 01923-3753
16179	Omni Spectra Inc. 140 Fourth Avenue Waltham, MA 02154
17856	Siliconix Inc. 2201 Laurelwood Road Santa Clara, CA 95054-1516
18736	Voltronics Corporation West Street P.O. Box 366 East Hanover, NJ 07936-2822
19212	Kings Electronics Inc. Tuckahoe, NY
21604	Buckeye Stamping Company 555 Marion Road Columbia, OH 43207
22526	Du Pont, E.I. deNemours and Company, Inc. Photo Products Department Berg Electronics Division Route 83 New Cumberland, PA 17070

Table 5-1. List of Manufacturers' Codes - Continued

Code	Manufacturer
23936	Pamotor Division William J. Purdy Company 770 Airport Boulevard Burlingame, CA 94010-1927
27264	Molex Products Company 5224 Katrine Avenue Donners Grove, IL 60515
27956	Relcom Mountain View, CA
28480	Hewlett-Packard Company 1501 Page Mill Road Palo Alto, CA 94304
30990	Connecting Devices Inc. 125 Lomita Street El Segundo, CA 90245
32997	Bourns, Inc. Trimpot Products Division 1200 Columbia Avenue Riverside, CA 92507
33095	Spectrum Control Inc. 152 East Main Street Fairview, PA 16415
51642	Centre Engineering Inc. 2820 East College Avenue State College, PA 16801-7515
55027	Q-Bit Corporation 2575 Pacific Avenue N.E. Palm Bay, FL 32905
55322	Samtec Inc. 810 Progress Boulevard P.O. Box 1147 New Albany, IN 47150
56289	Sprague Electric Company North Adams, MA 01247
59660	Tusonix Inc. 7741 N. Business Park Dr. P.O. Box 37144 Tucson, AZ 85740-7144
59942	U.S. Microtek Components 11144 Penrose St., Unit 7 Sun Valley, CA 91352-2749
64639	Micro-Coax Components Inc. 245 W. Fifth Avenue Trappe P.O. Box E Collegeville, PA 19426-2549
71279	Cambridge Thermionic Corp. 445 Concord Avenue Cambridge, MA 02138
71400	McGraw-Edison Company Bussman Mfg. Division 502 Earth City Plaza Earth City, MO 63045
73138	Beckman Instruments Inc. Helipot Division 2000 Harbor Boulevard Fullerton, CA 92634
73445	Amperex Electronic Corp. 230 Duffy Avenue Hicksville, NY 11802
73734	Federal Screw Products Inc. 3917 North Kedzie Avenue Chicago, IL 60618
75378	CTS Knights Inc. 400 Reimann Avenue Sandwich, IL 60548-1846
75915	Littelfuse Inc. 800 East Northwest Highway Des Plaines, IL 60016

Table 5-1. List of Manufacturers' Codes - Continued

Code	Manufacturer
80131	Electronic Industries Assoc. 2001 Eye Northwest Street Washington, D.C. 20006
80294	Bowers Inc. Instrument Division 6735 Magnolia Avenue Riverside, CA 92506
81073	Grayhill Inc. P.O. Box 373 561 Hill Grove Avenue La Grange, IL 60525
82389	Switchcraft Inc. 5555 North Elston Avenue Chicago, IL 60630
83250	Hamblin and Russell Manufacturing Co., Inc. Worcester, MA
83330	H.H. Smith Inc. 812 Snediker Avenue Brooklyn, NY 11207
83333	Technical Coating Inc. Pasadena, CA
91293	Johnson Manufacturing Co. P.O. Box 329 Boonton, NJ 07005
91345	Miller Dial Corporation Fotofoil Division 4400 N. Temple City Blvd. El Monte, CA 91734
91506	Augat Inc. P.O. Box 779 633 Perry Avenue Attleboro, MA 02703
95146	Alco Electronics Products Incorporated P.O. Box 1348 Lawrence, MA 01843
98291	Sealectro Corporation 225 Hoyt Mamaroneck, NY 10544
99800	American Precision Industries Inc. Delevan Division 270 Quaker Road East Aurora, NY 14052-2114

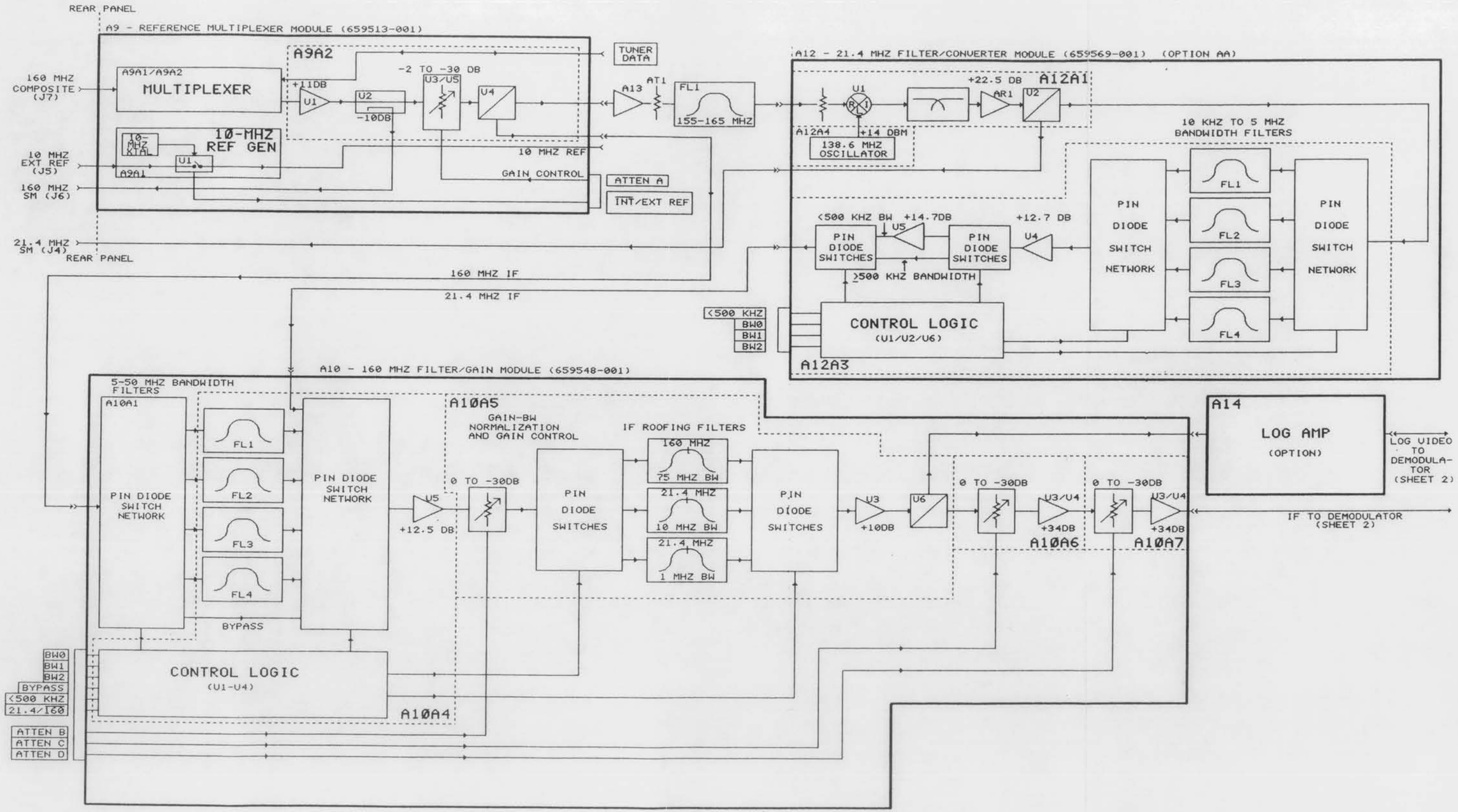


Figure 6-1. IFC Functional Block Diagram (Sheet 1 of 2)

87.B.9002/1

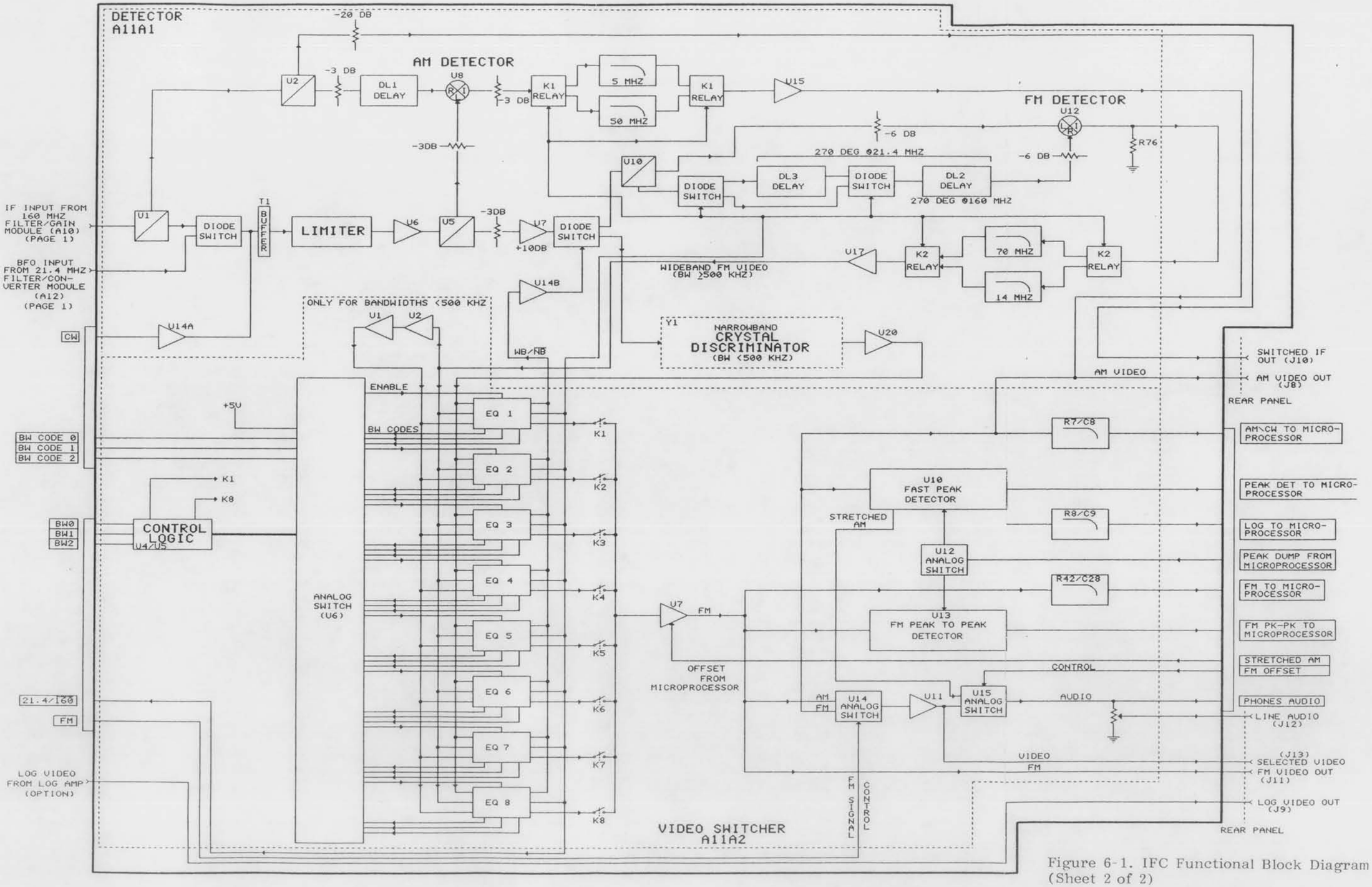


Figure 6-1. IFC Functional Block Diagram (Sheet 2 of 2)

87.B.9002/2

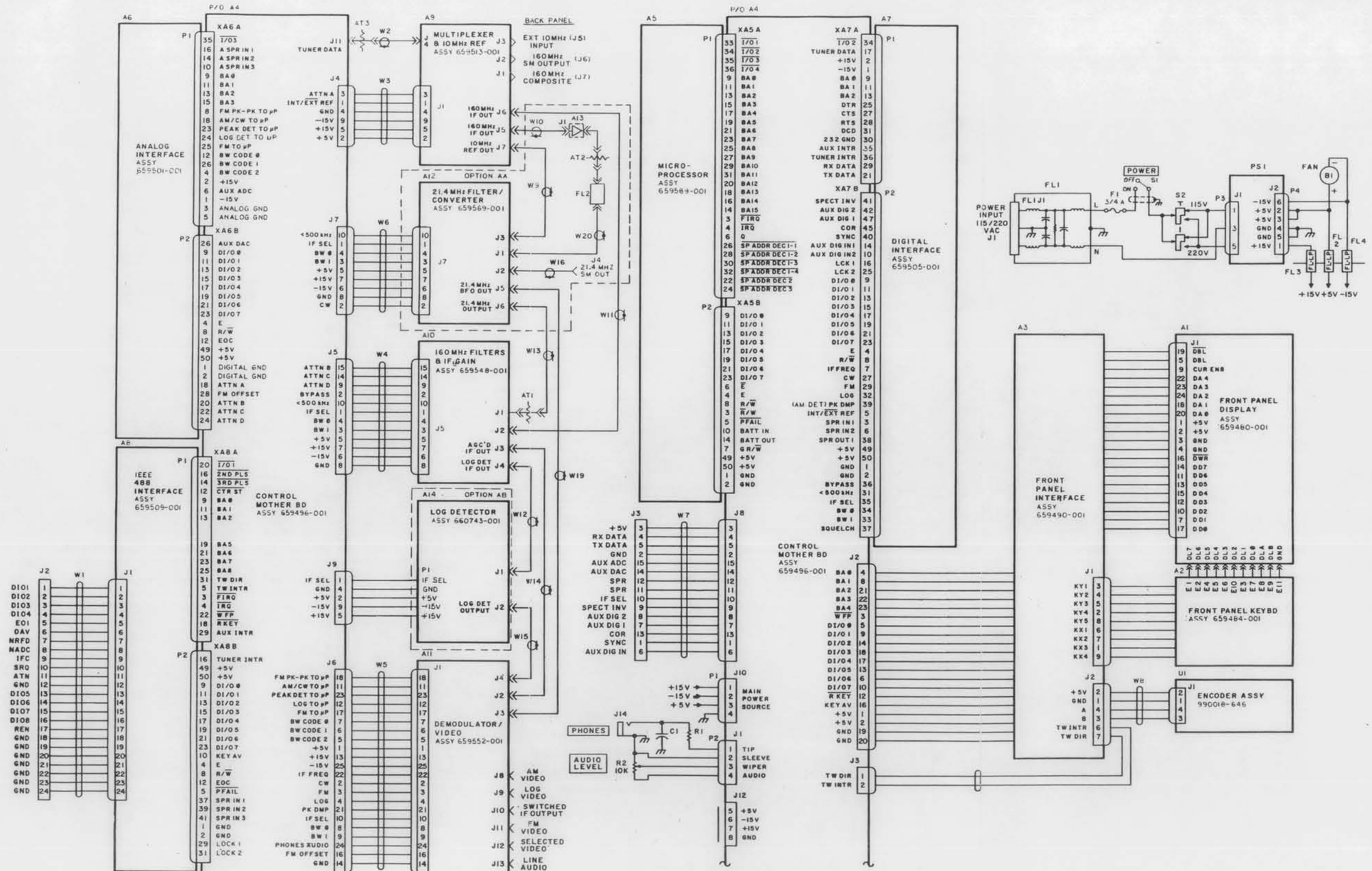
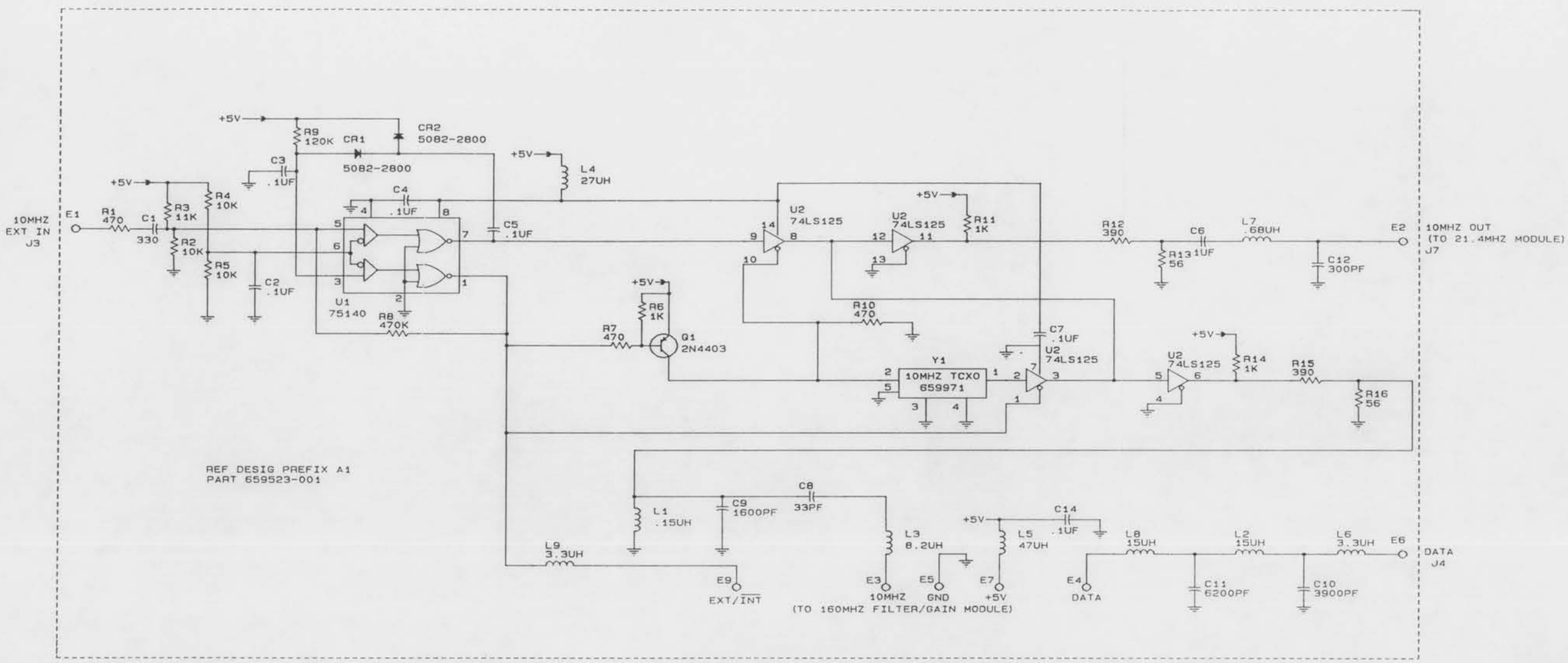


Figure 6-2. IFC Interconnect Diagram

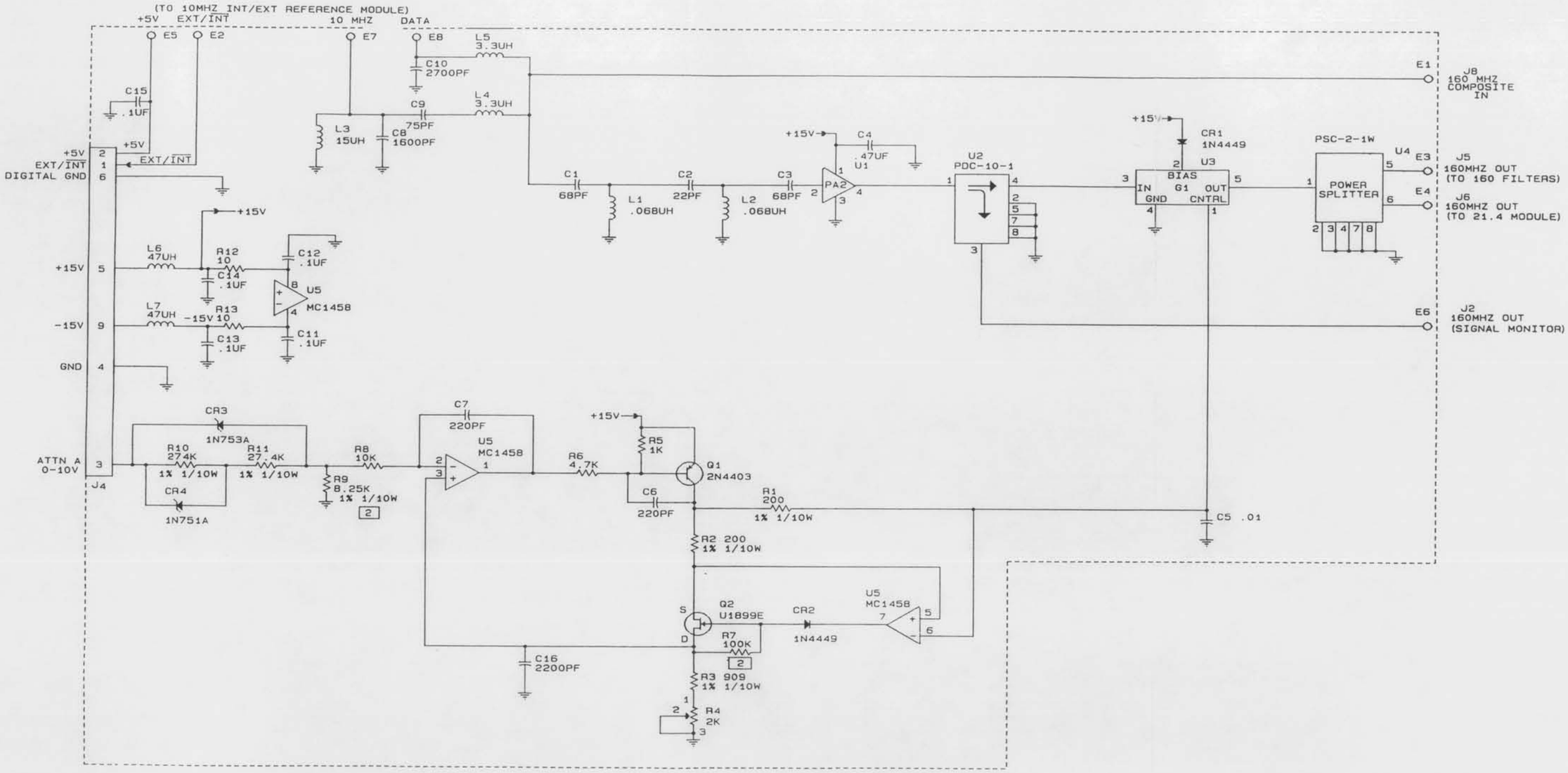
87.C.9004
(659452A)



NOTES: UNLESS OTHERWISE SPECIFIED
1. RESISTANCE IS IN OHMS, +/-5%, 1/4W
2. CAPACITANCE IS IN PF
3. INDUCTANCE IS IN UF (DELEVAN 1025 SERIES OR TECAL)

659526B

Figure 6-3. 10 MHz Internal/External Reference A9A1, Schematic Diagram



2 FACTORY SELECT NOMINAL VALUE SHOWN

1. A) RESISTANCE IS IN OHMS +-5% 1/4W.
   B) CAPACITANCE IS IN PF.
   C) INDUCTANCE IS IN UH.

NOTES: UNLESS OTHERWISE SPECIFIED

87.C.9005
(659530C)

Figure 6-4. 160 MHz Filter/Gain Control A9A2, Schematic Diagram

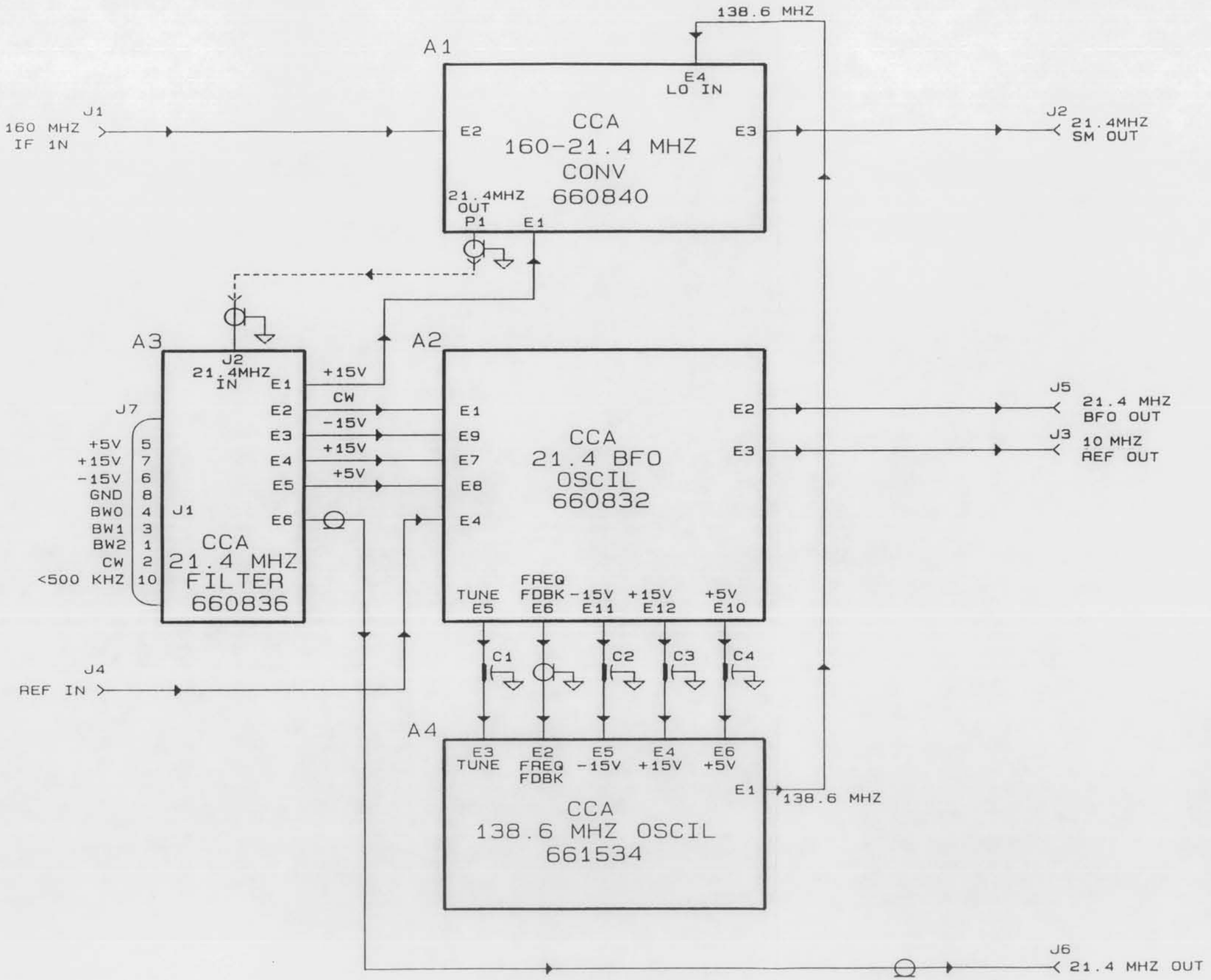
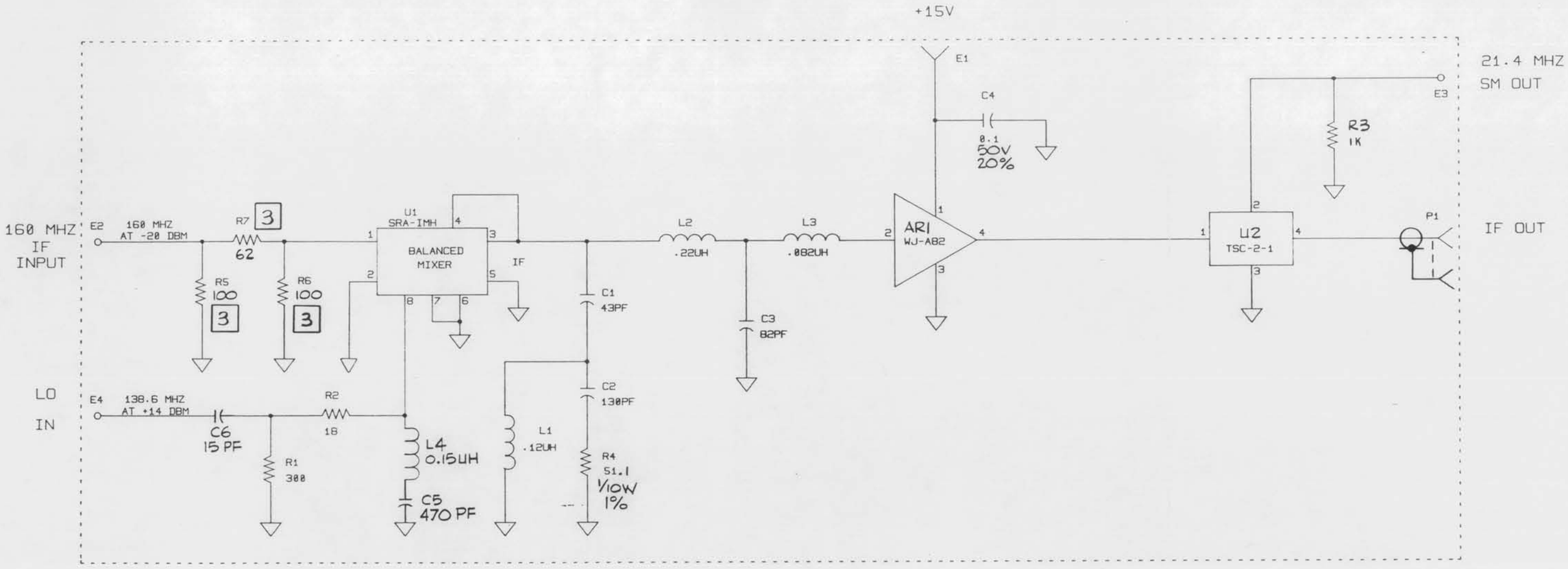


Figure 6-5. 21.4 MHz Filter/Converter A12, Interconnect Diagram

87.C.9006
(661464)



3 FACTORY SELECT. NOMINAL VALUE SHOWN.

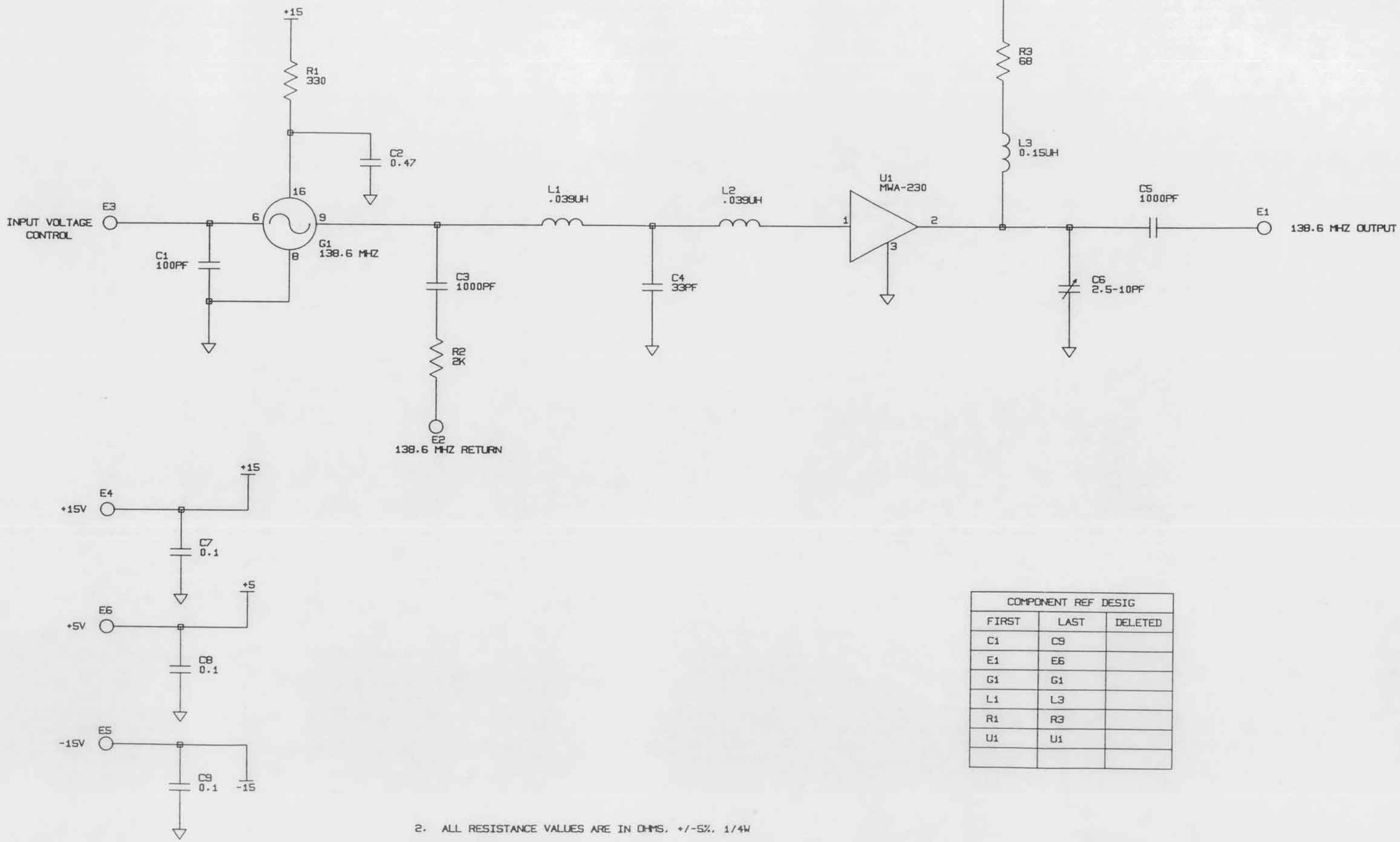
2. ALL CAPACITANCE VALUES ARE IN UF, ± 2%, 100V

1. ALL RESISTANCE VALUES ARE IN OHMS, ± 5%, 1/4 W

NOTES: UNLESS OTHERWISE SPECIFIED

COMPONENT REF. DESIGN.		
FIRST	LAST	DELETED
C1	C6	
L1	L4	
R1	R7	
U1	U2	
AR1	AR1	

Figure 6-6. 160 MHz to 21.4 MHz Converter A12A1, Schematic Diagram



COMPONENT REF DESIG		
FIRST	LAST	DELETED
C1	C9	
E1	E6	
G1	G1	
L1	L3	
R1	R3	
U1	U1	

2. ALL RESISTANCE VALUES ARE IN OHMS, +/-5%, 1/4W

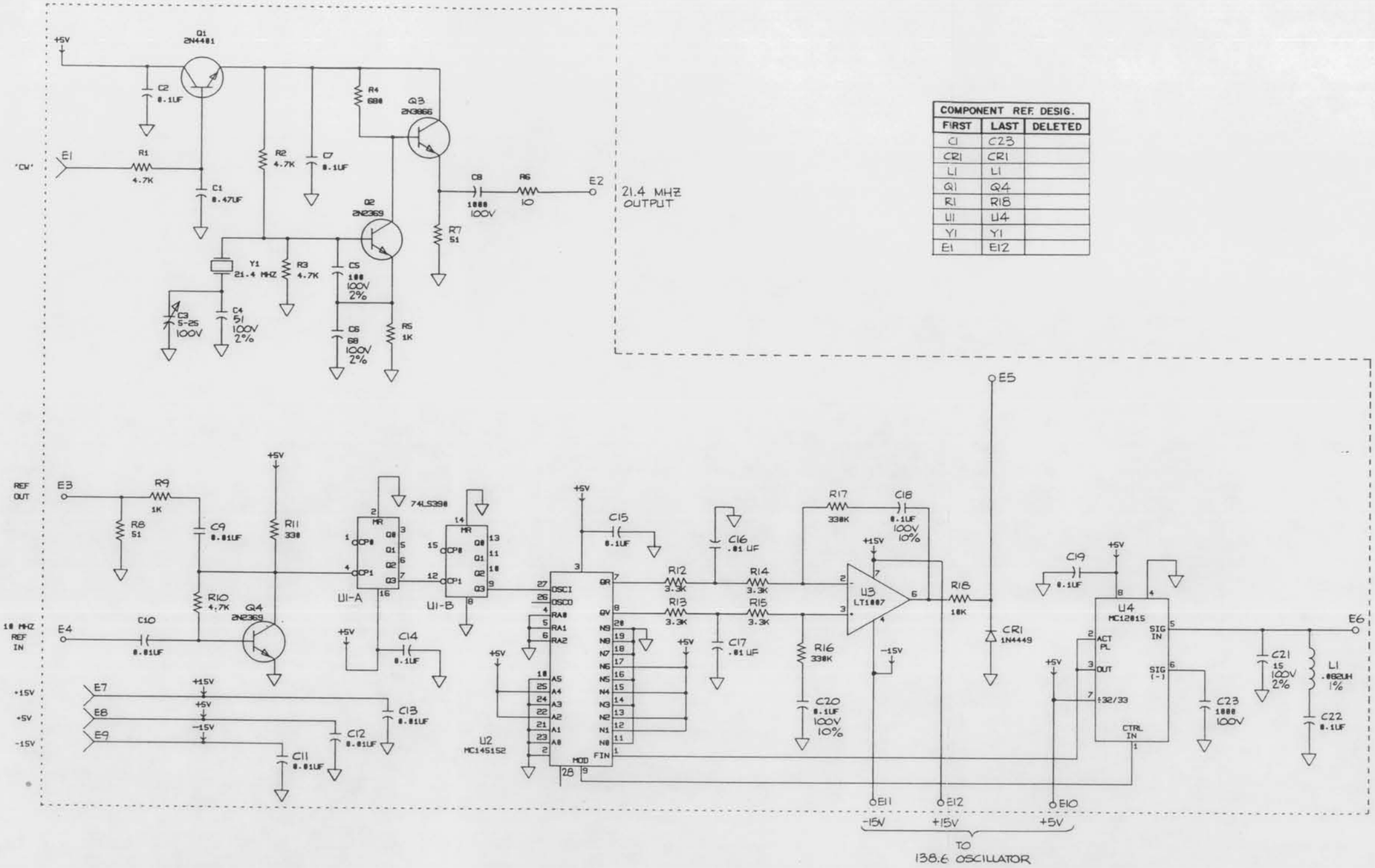
1. ALL CAPACITANCE VALUES ARE IN UF

NOTES: UNLESS OTHERWISE SPECIFIED

661537

Figure 6-7. 138.6 MHz Oscillator A12A4, Schematic Diagram

COMPONENT REF. DESIG.		
FIRST	LAST	DELETED
C1	C23	
CR1	CR1	
L1	L1	
Q1	Q4	
R1	R18	
U1	U4	
Y1	Y1	
E1	E12	

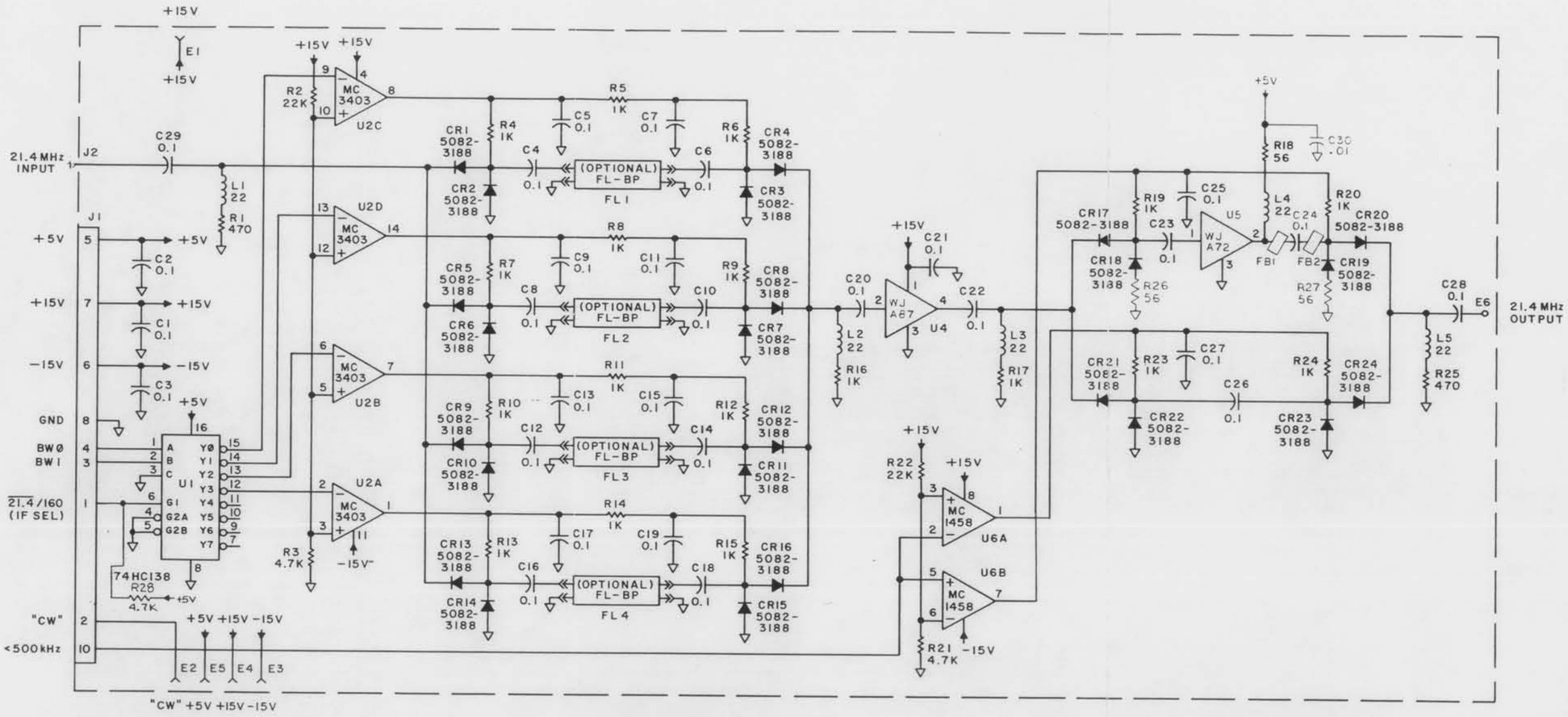


2. ALL RESISTANCE VALUES ARE IN OHMS, ± 5%, 1/4W
1. ALL CAPACITANCE VALUES ARE IN PF, ± 20%, 50V.

NOTES: UNLESS OTHERWISE SPECIFIED

660835

Figure 6-8. 21.4 BFO Oscillator A12A2, Schematic Diagram



NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/4W.
   b) CAPACITANCE IS IN μF.
   c) INDUCTANCE IS IN μH.

659580A

Figure 6-9. 21.4 MHz IF Filter A12A3, Schematic Diagram

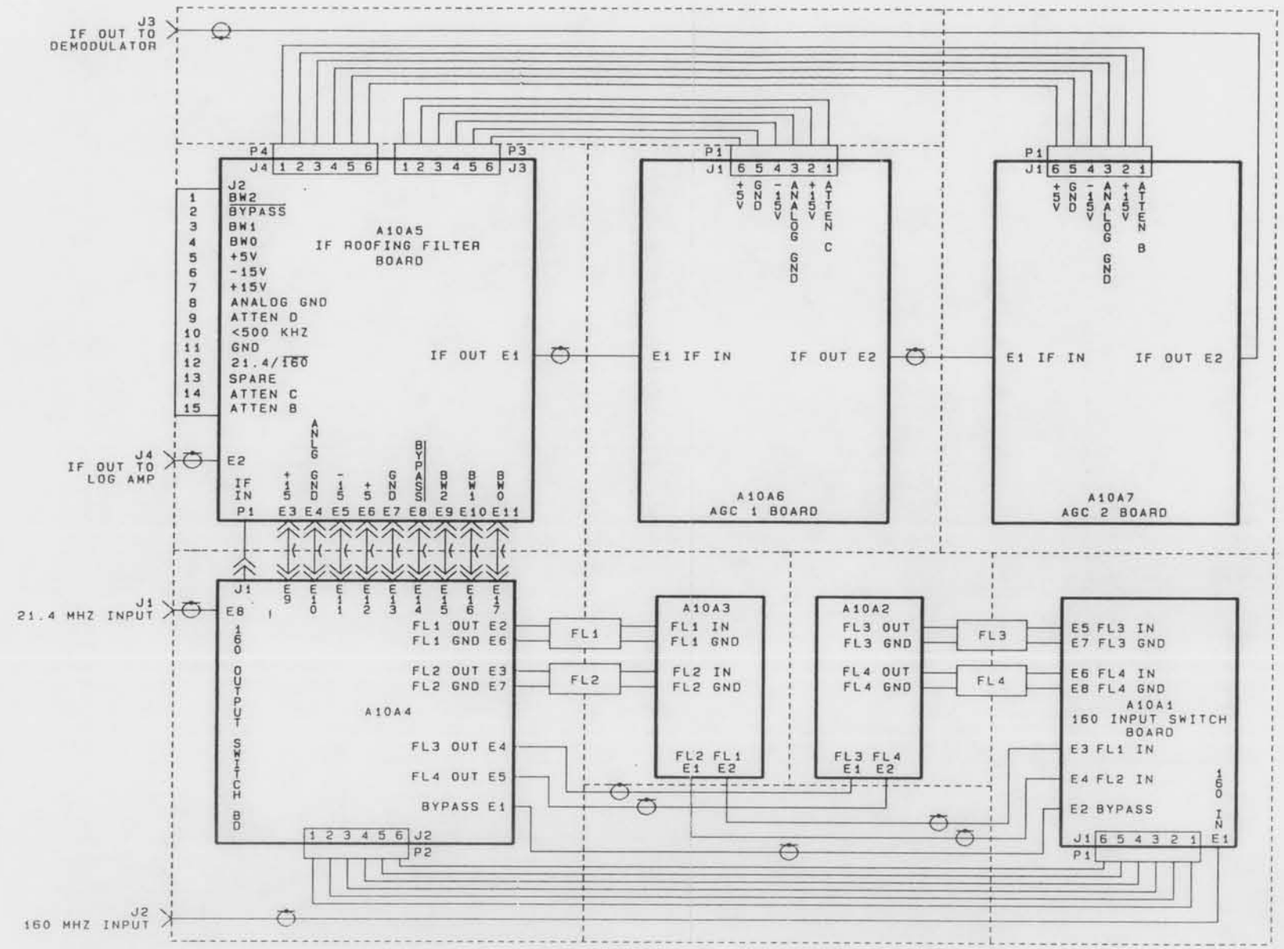
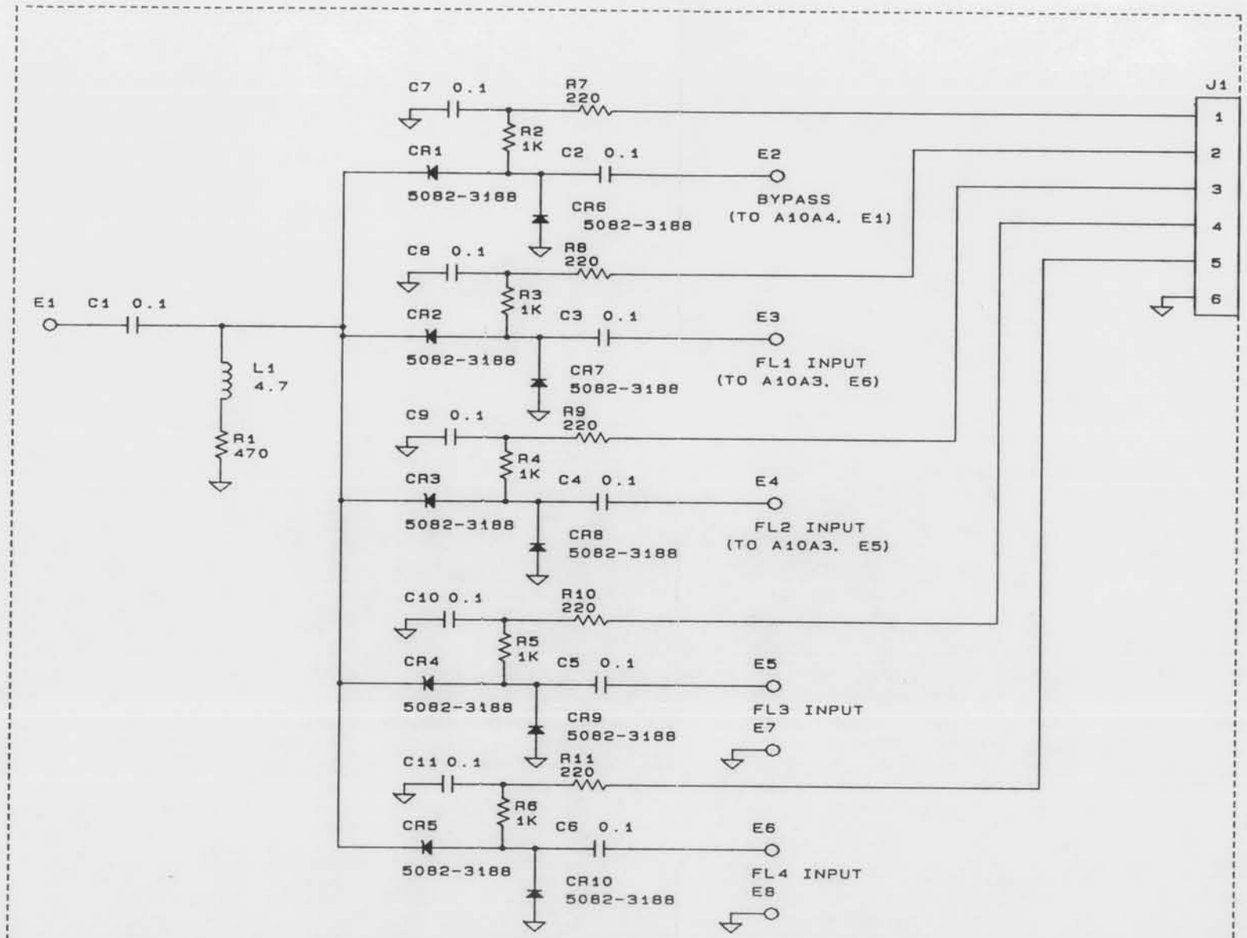


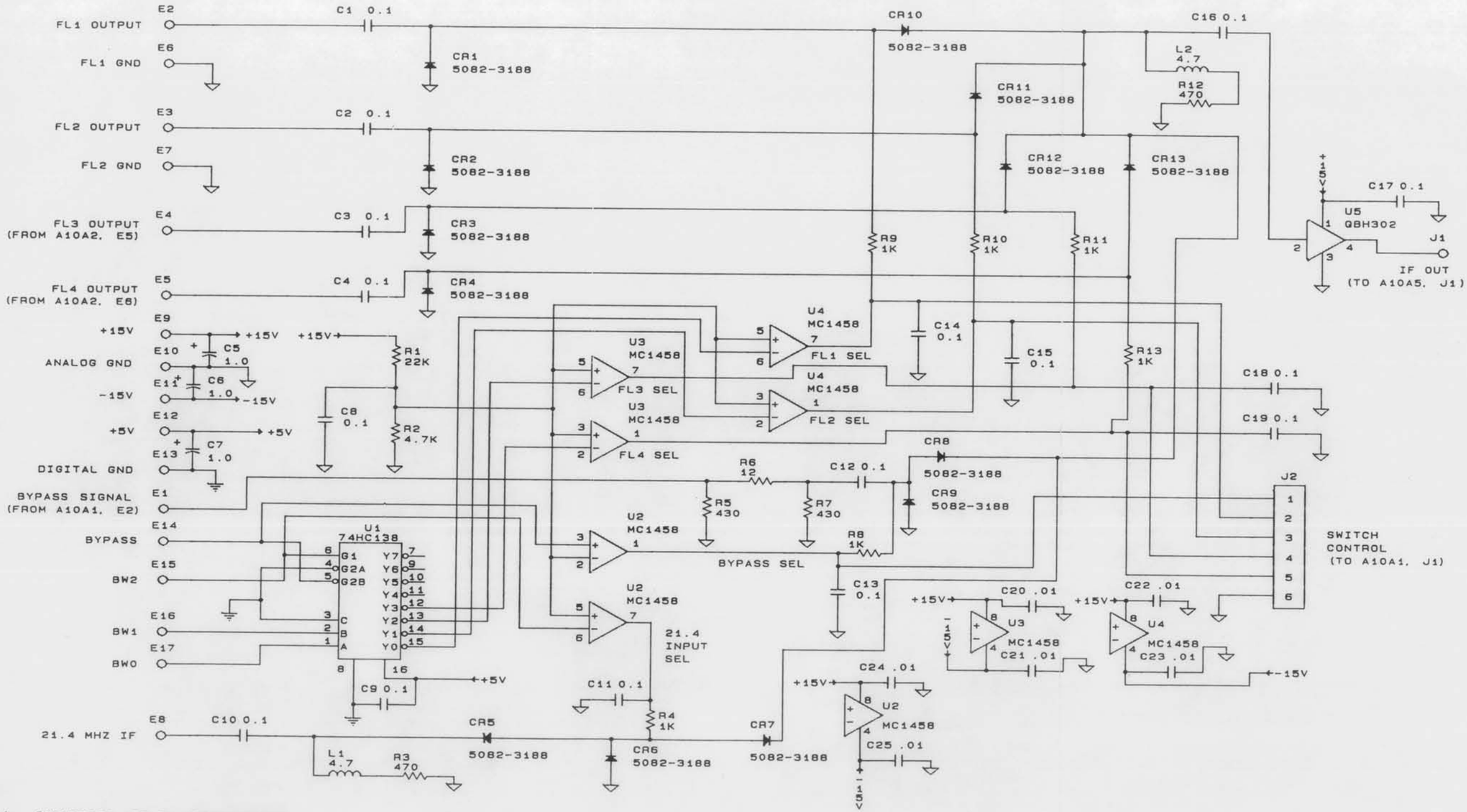
Figure 6-10. 160 MHz Filter/Gain Module A10, Interconnect Diagram



4. INDUCTORS ARE IN MICROHENRIES
3. SIGNAL LINES ARE 50 OHMS.
2. CAPACITORS ARE SPECIFIED IN MICROFARADS/VOLTS (50 VOLTS UNLESS SPECIFIED).
1. ALL RESISTORS ARE 1/8W, 5%
NOTES: UNLESS OTHERWISE SPECIFIED

Figure 6-11. Input Switch A10A1, Schematic Diagram

660037

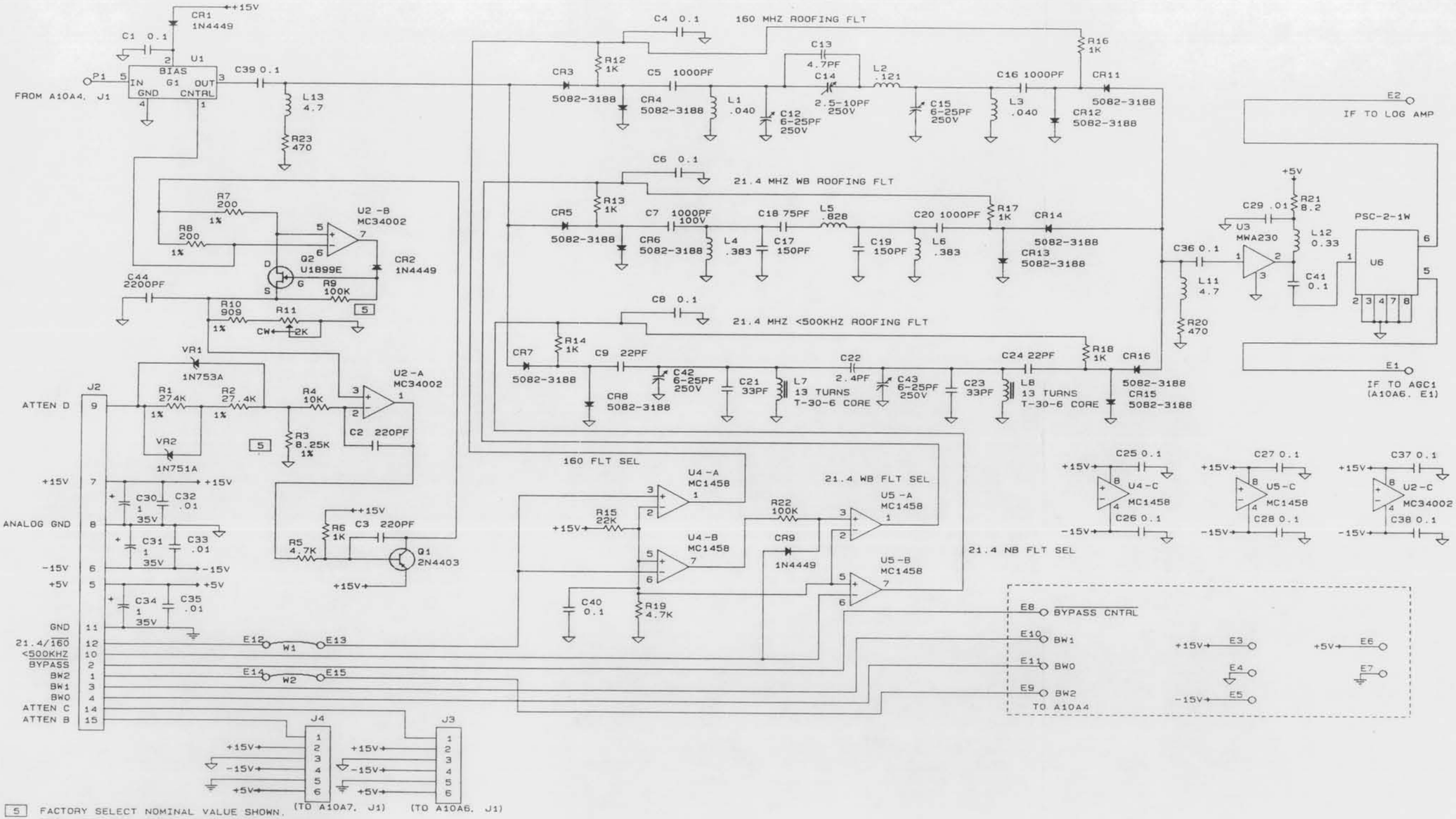


4. INDUCTORS ARE IN MICROHENRIES
3. CAPACITORS ARE IN MICROFARADS/VOLT (50 VOLT UNLESS SPECIFIED)
2. RESISTORS ARE 1/8W, 5%
1. SIGNAL LINES (NOT SEL OR CNTL LINES) ARE 50 OHMS.

NOTES: UNLESS OTHERWISE SPECIFIED

660041A

Figure 6-12. Output Switch A10A4, Schematic Diagram



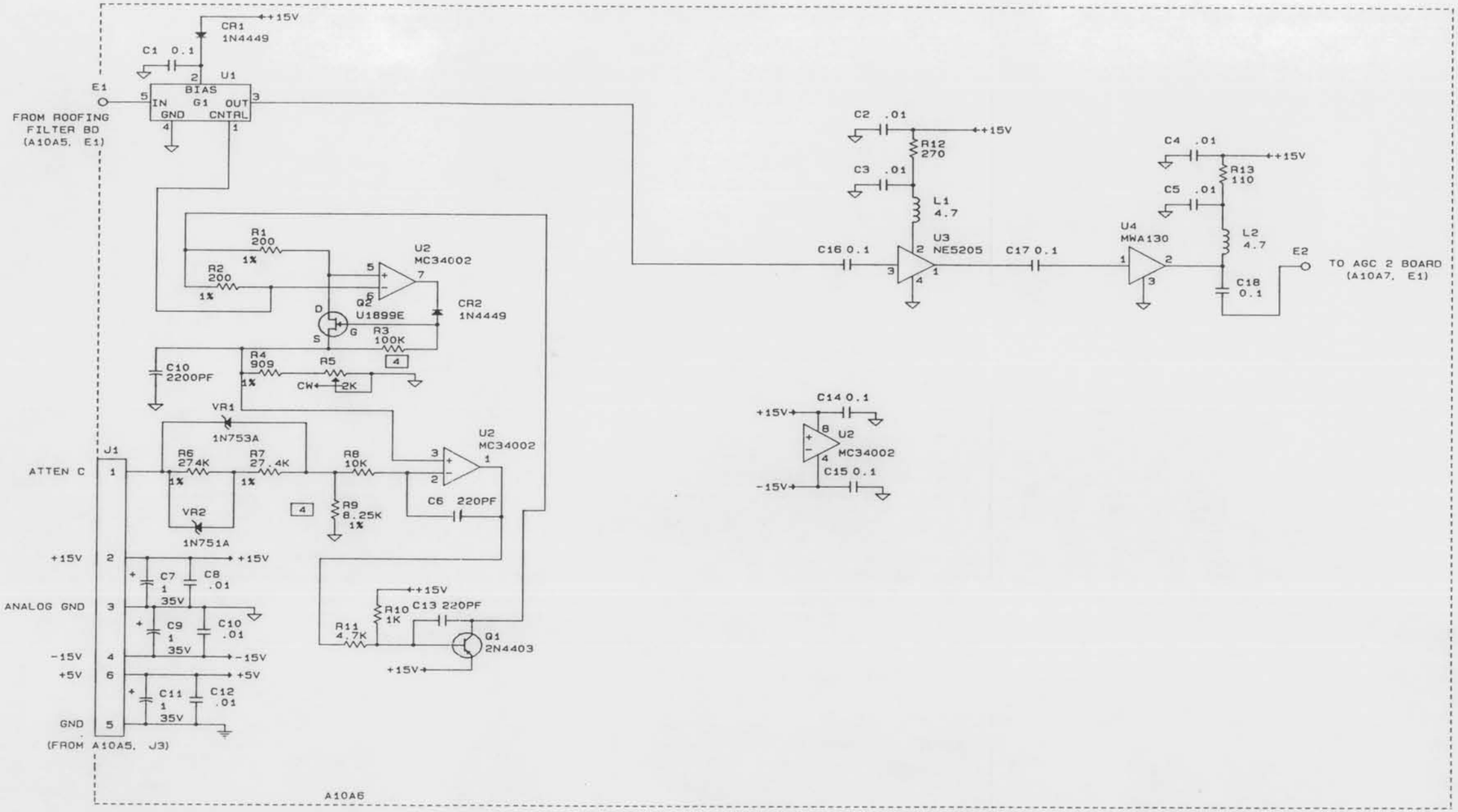
5 FACTORY SELECT NOMINAL VALUE SHOWN.

4. WHEN USED ON WJ8969, THIS BOARD IS A10A5.
3. INDUCTORS ARE IN MICROHENRIES.
2. CAPACITOR VALUES ARE IN MICROFARADS, 50V.
1. ALL RESISTORS ARE 1/4W, 5%, VALUES IN OHMS.

NOTES: UNLESS OTHERWISE SPECIFIED

Figure 6-13. IF Roofing Filter A10A5, Schematic Diagram

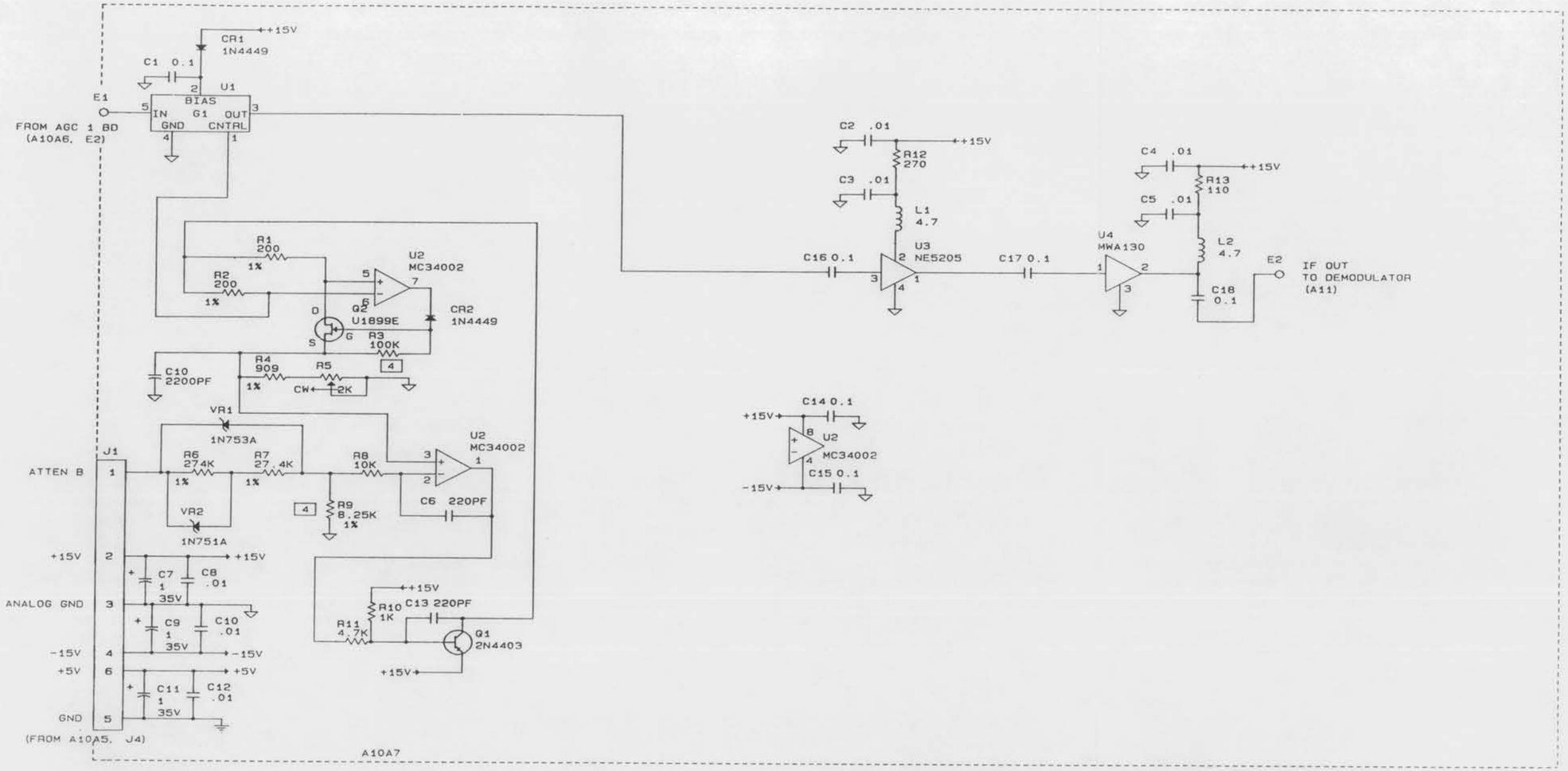
659547C



4 FACTORY SELECT, NOMINAL VALUE SHOWN
3. INDUCTORS ARE IN MICROHENRIES.
2. CAPACITORS ARE IN MICROFARAD/VOLT (50 VOLTS UNLESS SPECIFIED).
1. ALL RESISTORS ARE 1/4W, 5%, VALUES IN OHMS.
NOTES: UNLESS OTHERWISE SPECIFIED

659543A

Figure 6-14. AGC 1 (Automatic Gain Control) A10A6, Schematic Diagram



4 FACTORY SELECT, NOMINAL VALUE SHOWN

3. INDUCTORS ARE IN MICROHENRIES.
2. CAPACITORS ARE IN MICROFARAD/VOLT (50 VOLTS UNLESS SPECIFIED).
1. ALL RESISTORS ARE 1/4W, 5%, VALUES IN OHMS.

NOTES: UNLESS OTHERWISE SPECIFIED

659539A

Figure 6-15. AGC 2 (Automatic Gain Control) A10A7, Schematic Diagram

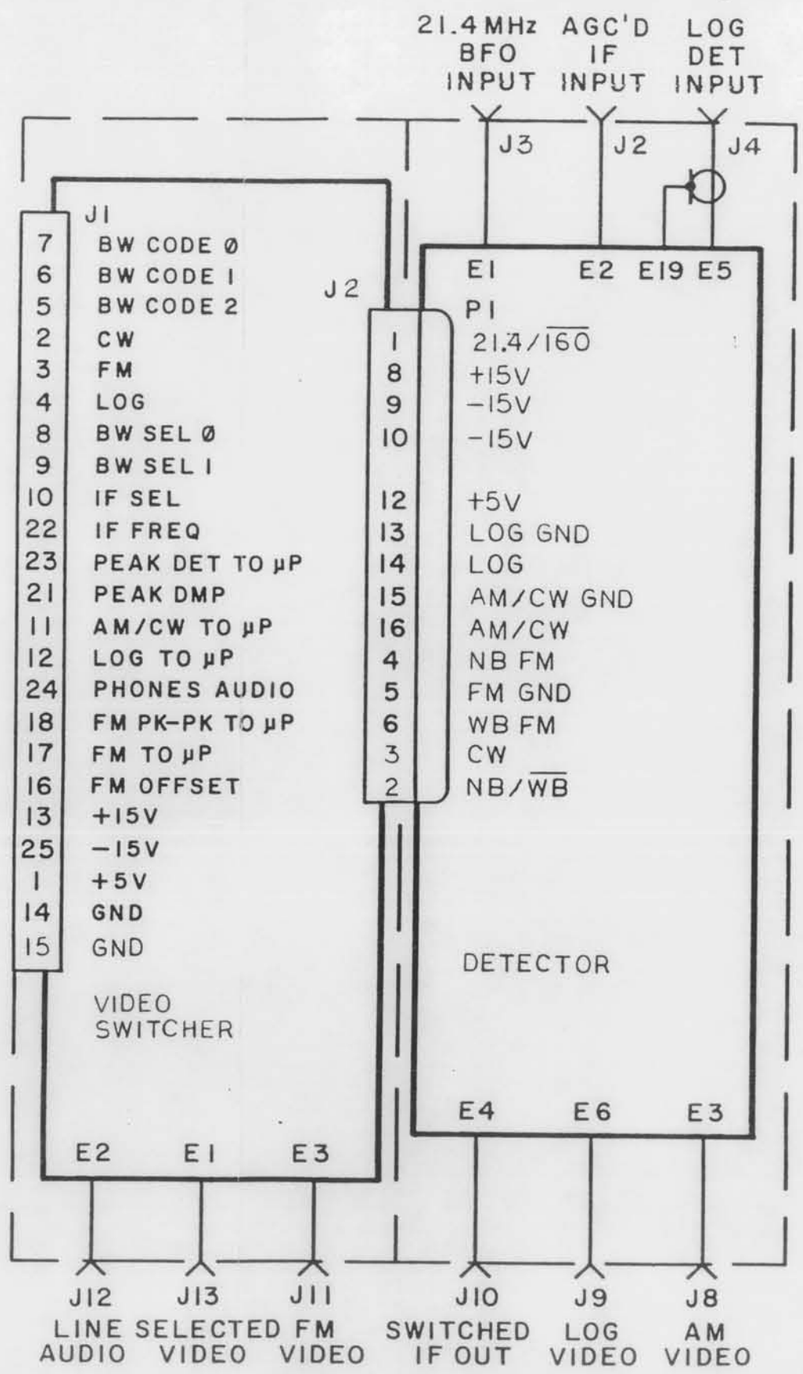
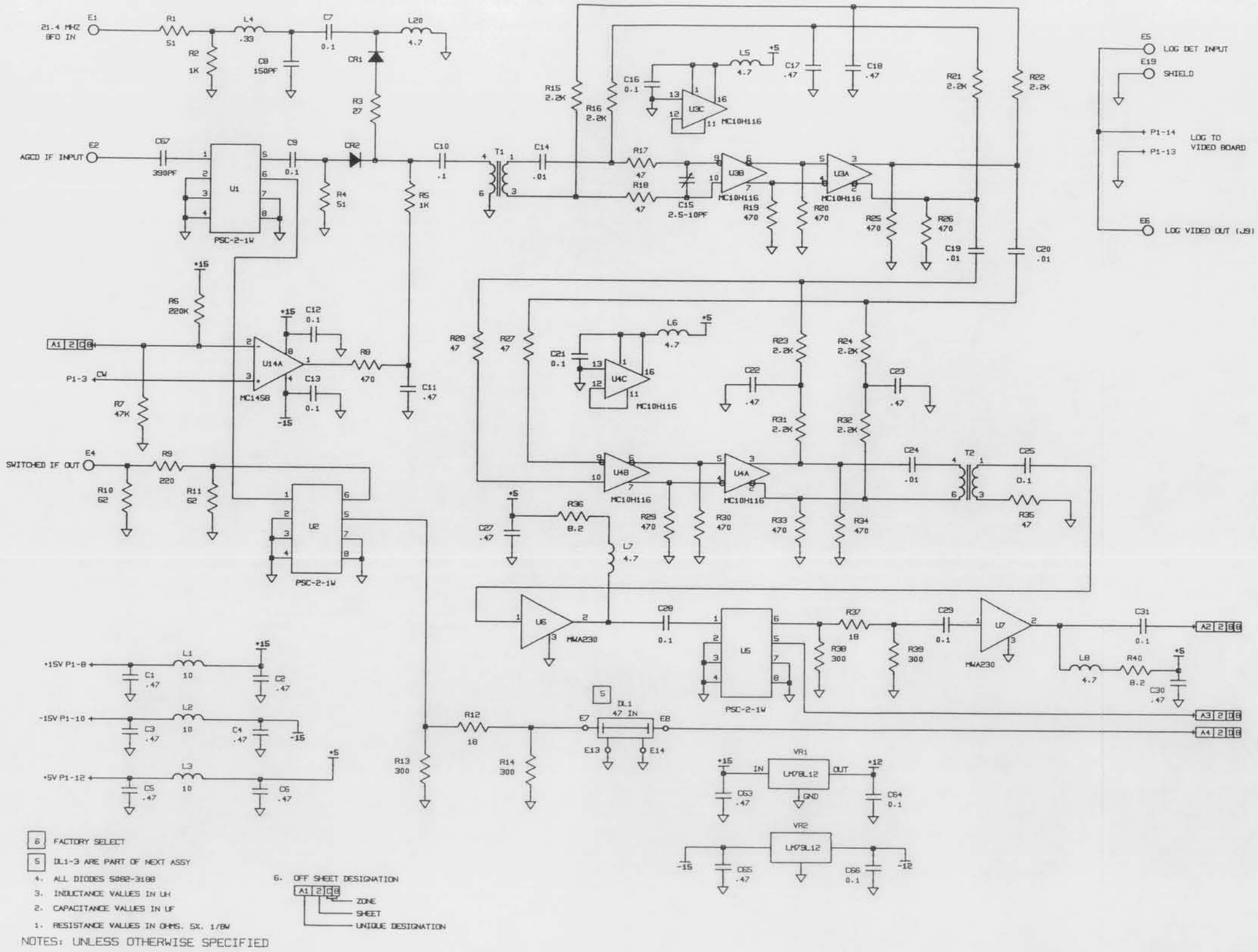


Figure 6-16. Detector/Video Switcher A11, Interconnect Diagram



INTEGRATED CIRCUIT IDENTIFICATION TABLE					
REF DESIG	TYPE	+15V	VCC	GND	-15V
U1,U2,U5,U10	PSC-2-1W			2-4, 7,8	
U3,U4	MC10H116			8	
U6,U7	MWA230				
U8,U12	SRA-1W			2, 5-7	
U11,U14	MC1458	8			4
U15,U17	CLC300A			24	
U16,18,20	LT1007	7			4
U19	DG188	6			9
VR1	78L12				
VR2	79L12				
T1,T2	MCLTI-1				

COMPONENT REF DESIG		
FIRST	LAST	DELETED
C1	C67	C26
CR1	CR14	
DL1	DL3	
E1	E19	
K1	K2	
L1	L20	
P1	P1	
Q1	Q2	
R1	R103	R41.101
T1	T2	
U1	U20	U9,13
VR1	VR2	
Y1	Y1	

Figure 6-17. Detector A11A1, Schematic Diagram (Sheet 1 of 2)

659564B/1

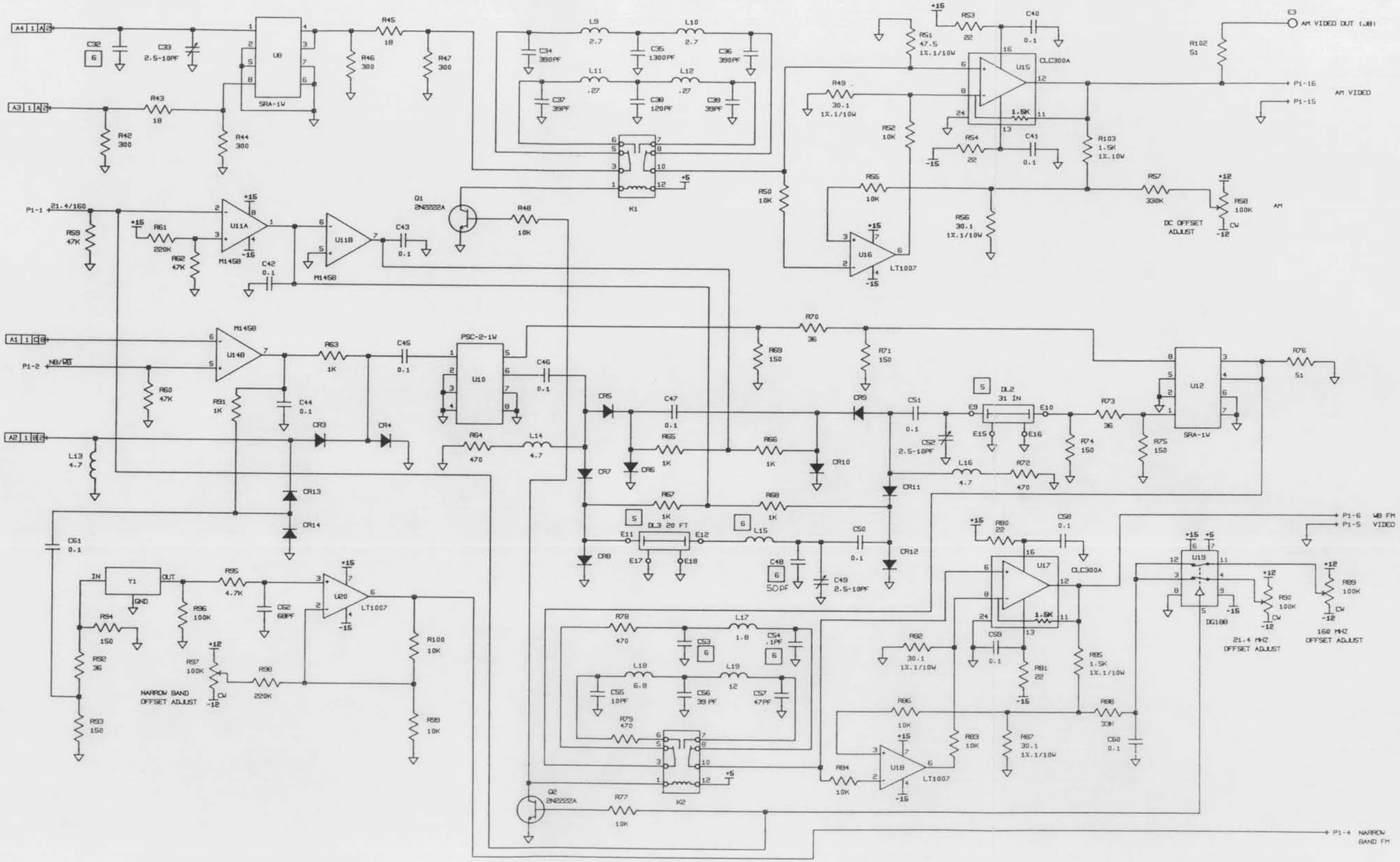
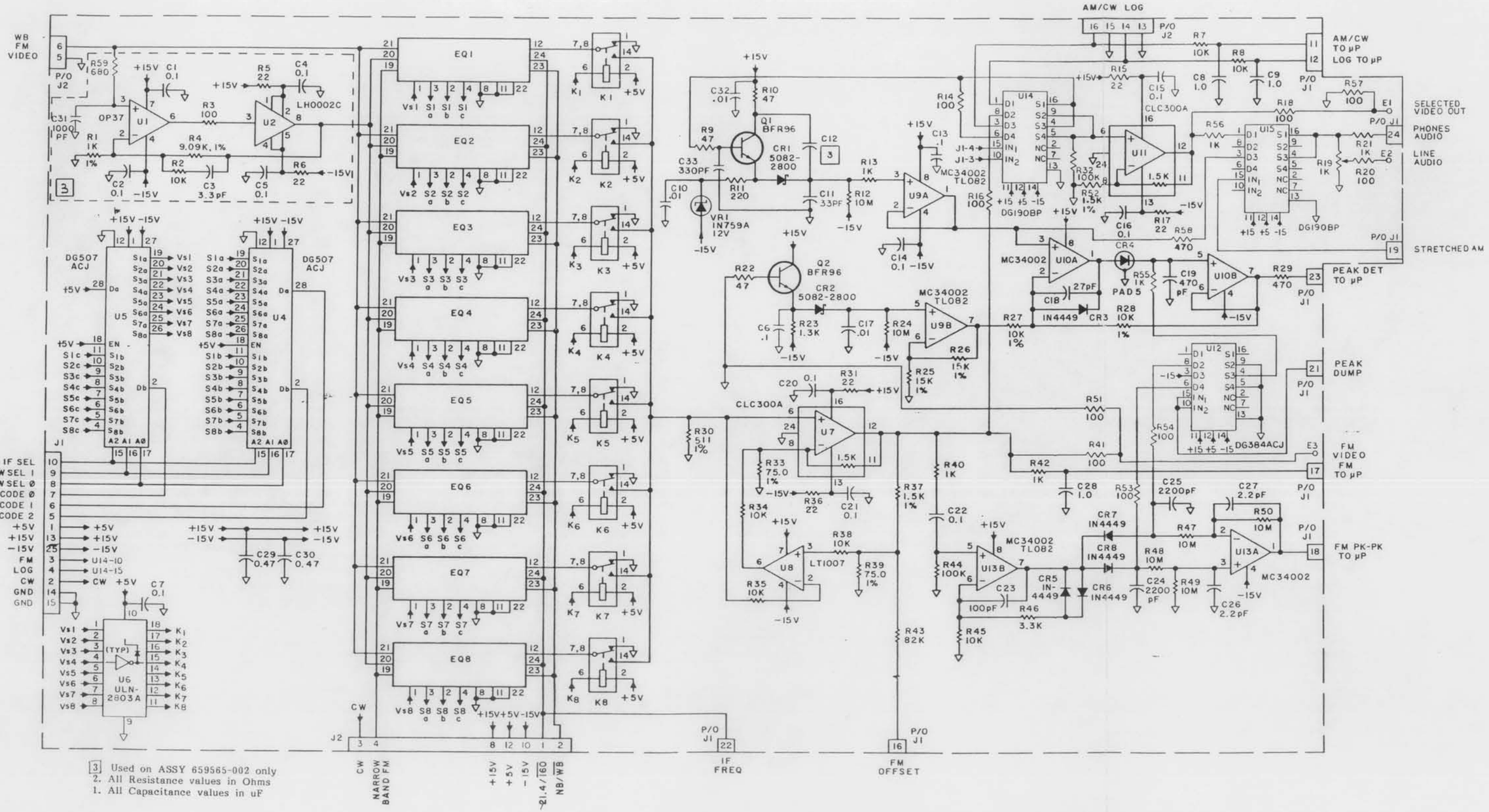


Figure 6-17. Detector A11A1, Schematic Diagram (Sheet 2 of 2)

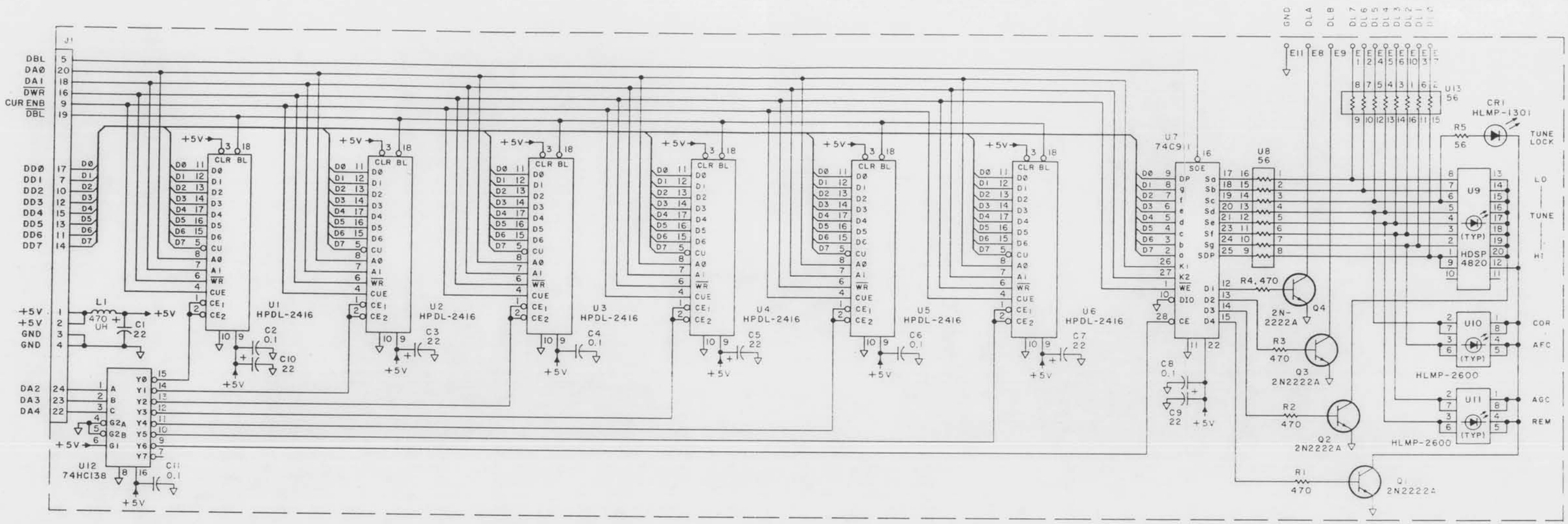
659564B/2



3 Used on ASSY 659565-002 only
2. All Resistance values in Ohms
1. All Capacitance values in uF

87.C.9008
(659568B)

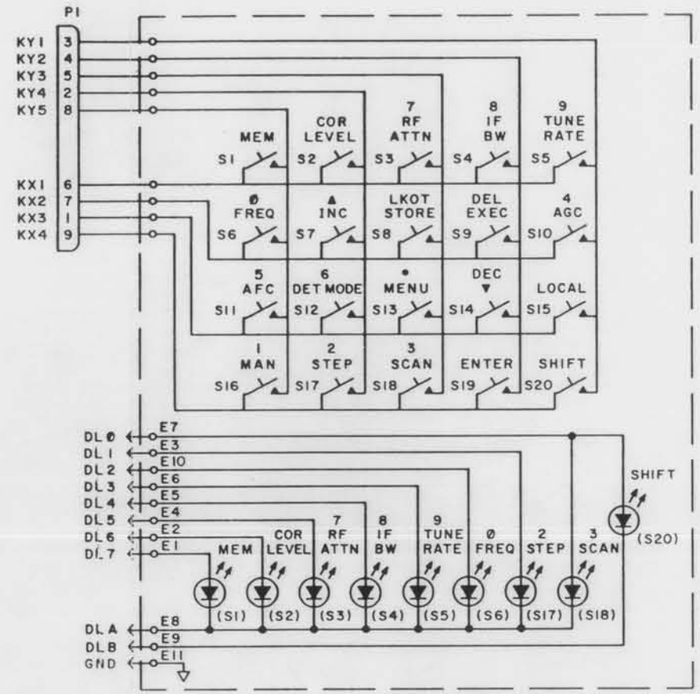
Figure 6-18. Video Switcher A11A2, Schematic Diagram



NOTES
1. UNLESS OTHERWISE SPECIFIED.
   a) RESISTANCE IS IN OHMS, ±5%, 1/8W.
   b) CAPACITANCE IS IN µF.

659483

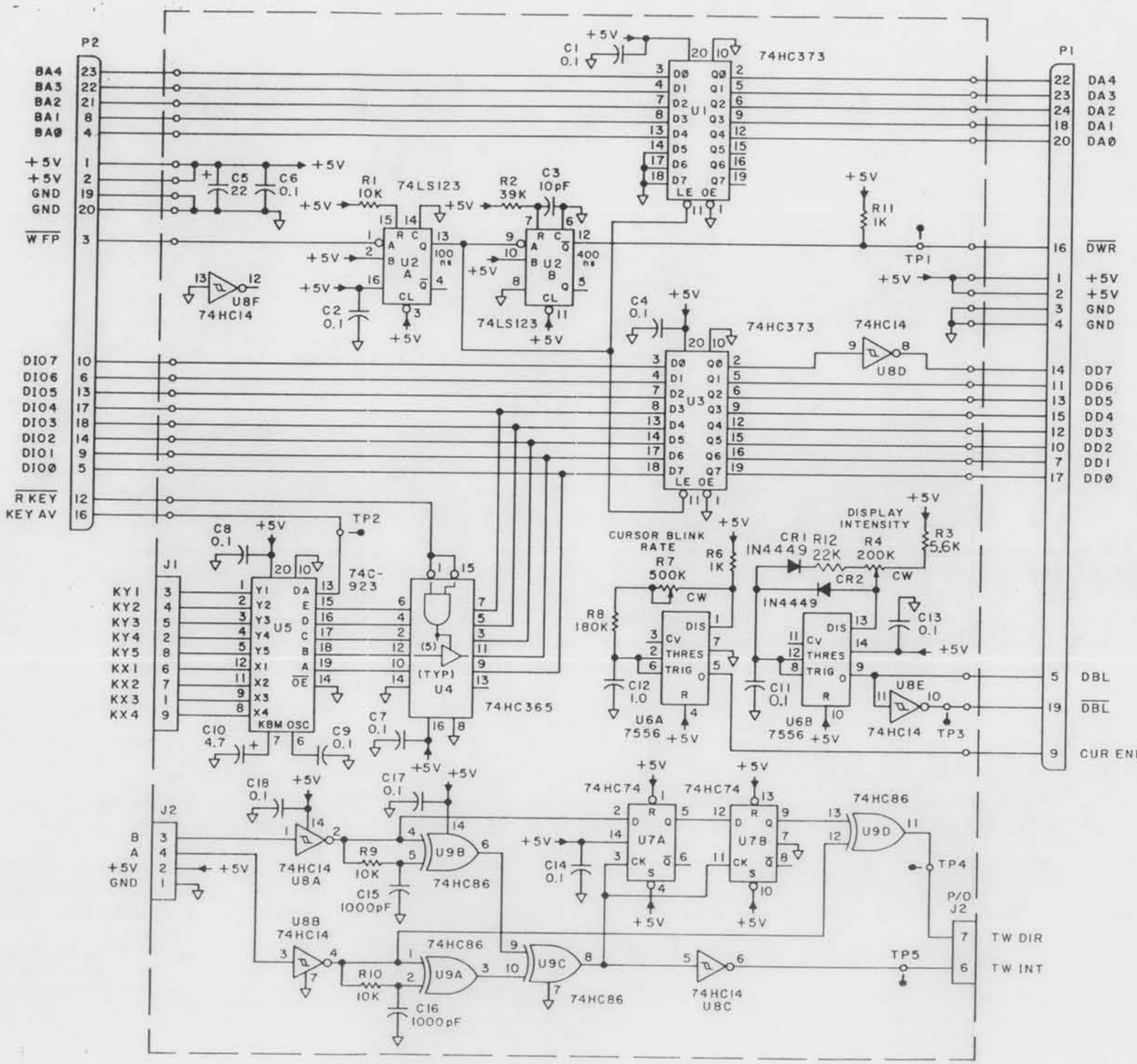
Figure 6-19. Front Panel Display A1, Schematic Diagram



NOTE: LED'S ARE PART OF SWITCHES OF THE SAME FUNCTIONS.

Figure 6-20. Front Panel Keyboard A2, Schematic Diagram

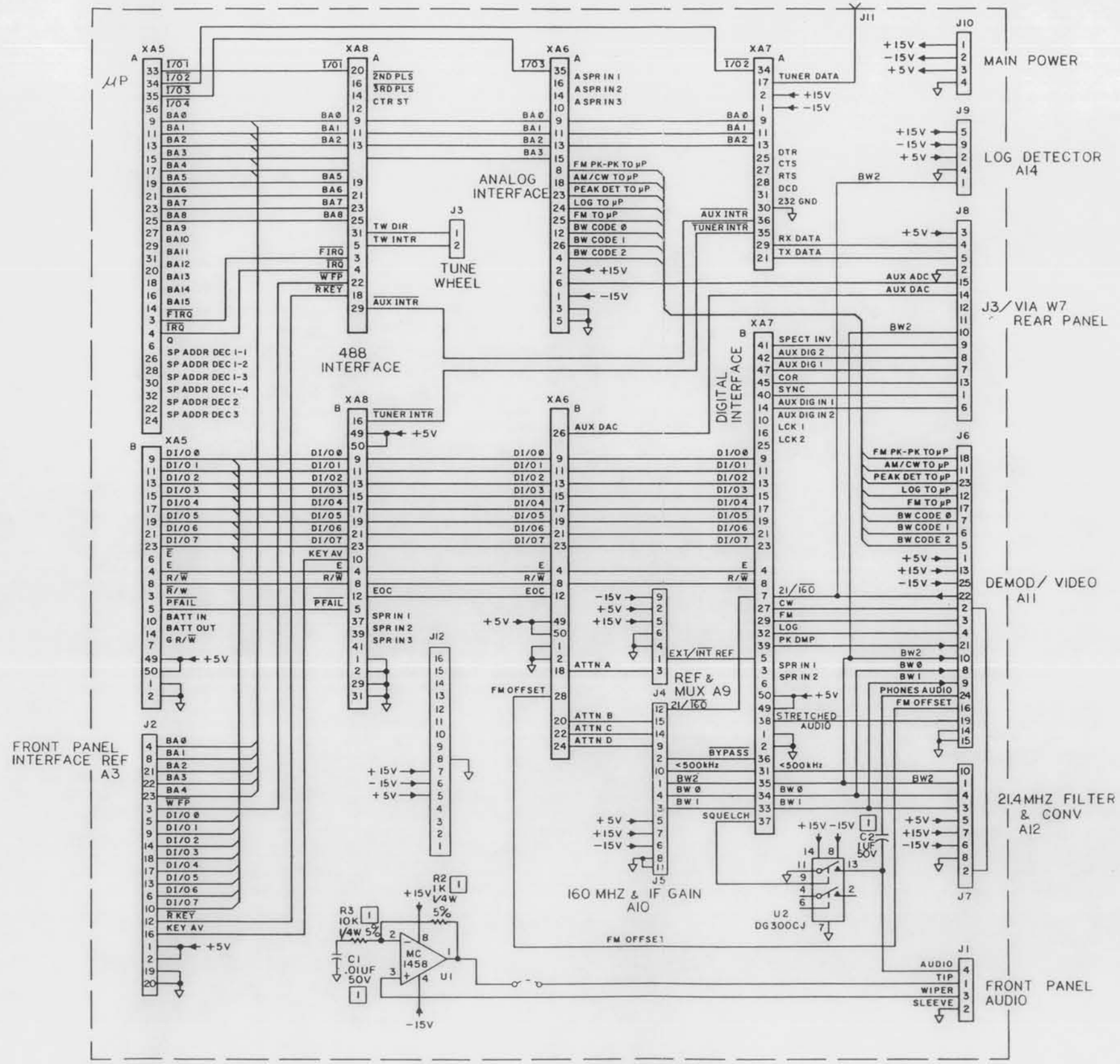
659487



NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±5%, 1/8W
   b) CAPACITANCE IS IN μF.

Figure 6-21. Front Panel Interface A3, Schematic Diagram

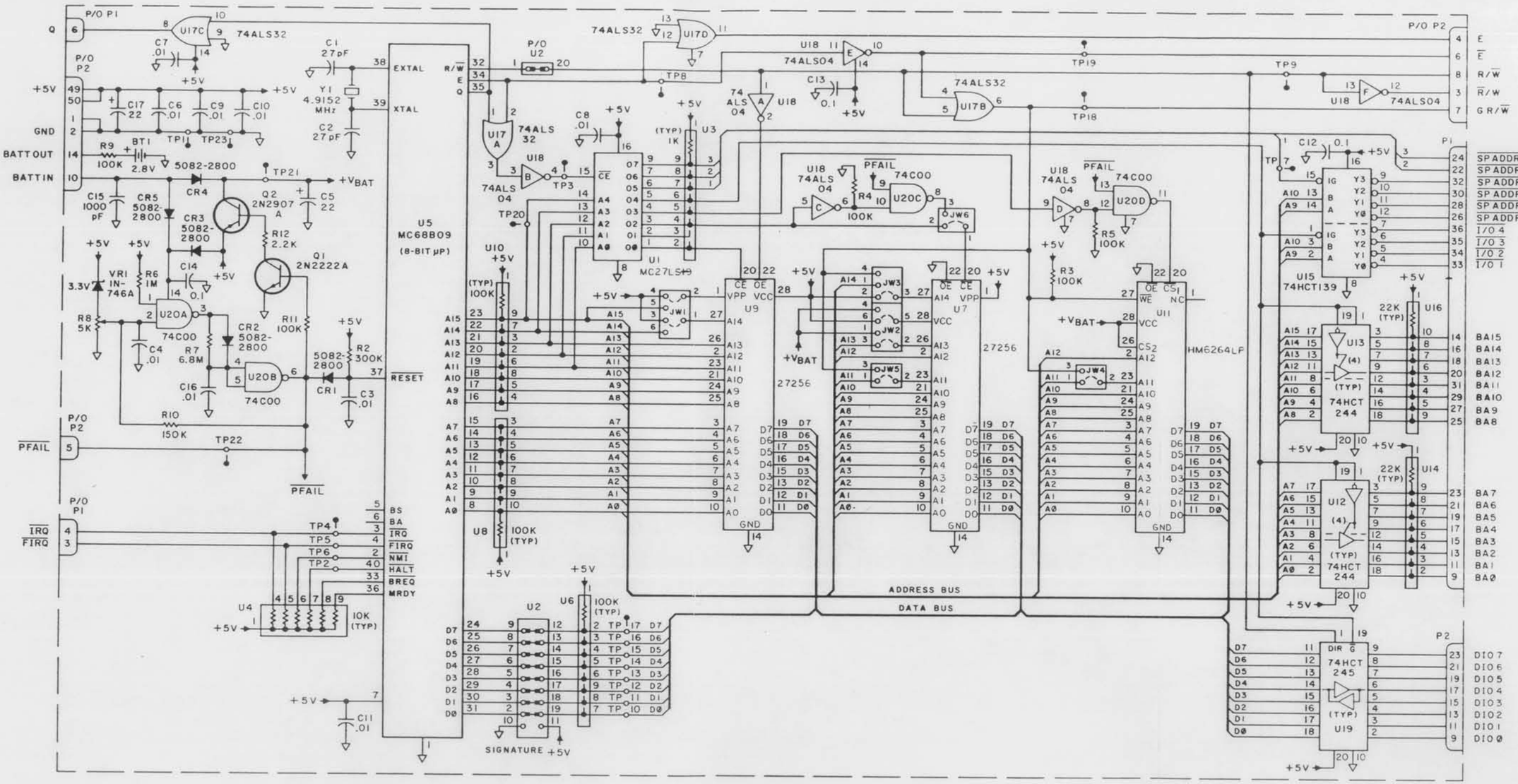
659493



[1] FACTORY SELECT. VALUE DETERMINED AT TEST.

87.C.9009
(659499B)

Figure 6-22. Control Mother Board A4, Schematic Diagram



3 SEE TABLE FOR JUMPER WIRES

2. ALL RESISTANCE VALUES IN OHMS, ± 5 %, 1/8 W

1. ALL CAPACITANCE VALUES IN UF

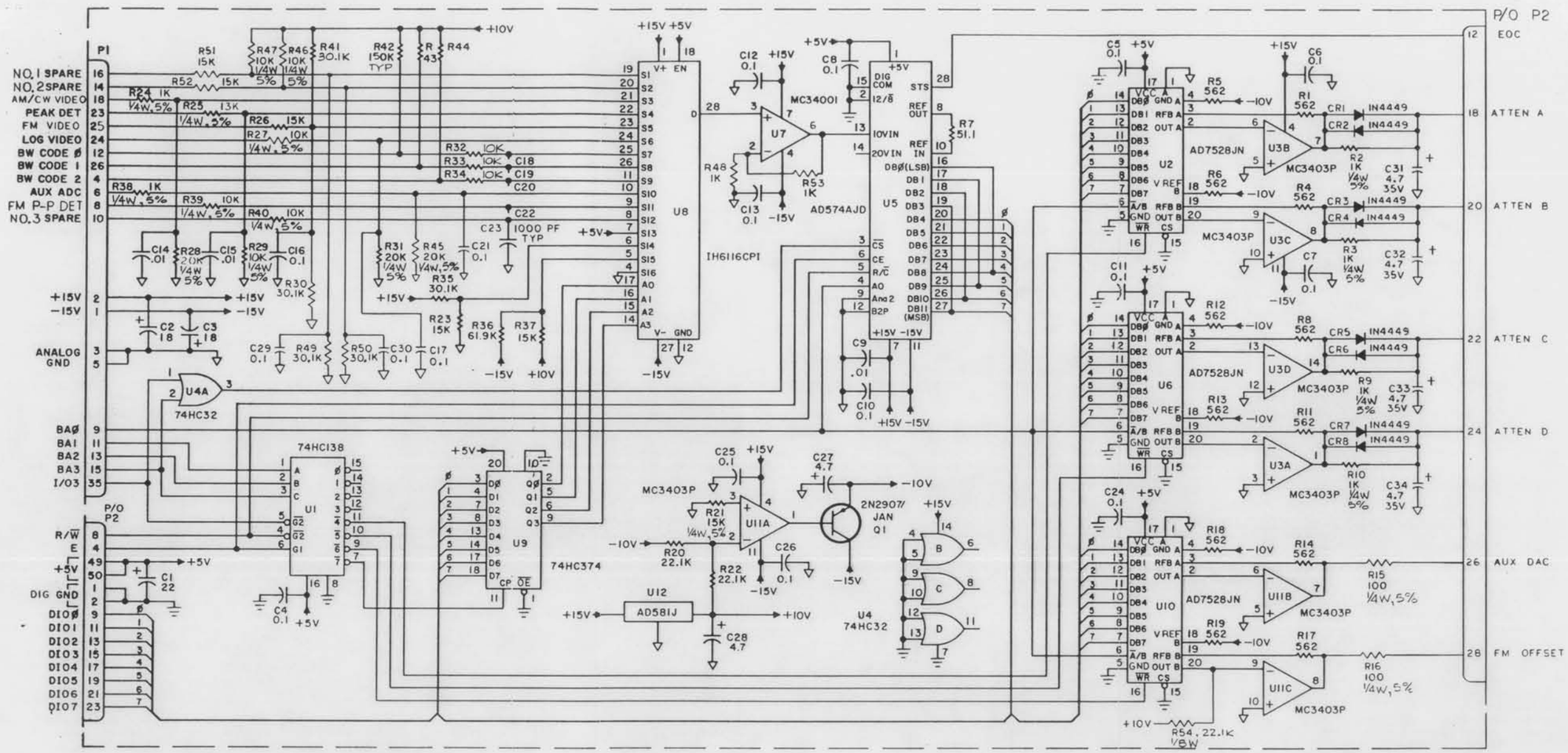
NOTES: UNLESS OTHERWISE SPECIFIED

659592

3

JUMPER TABLE						
ASSY NO.	JW1	JW2	JW3	JW4	JW5	JW6
659589-001	1-6, 2-4	2-3, 5-6	1-3	1-2	1-2	1-2

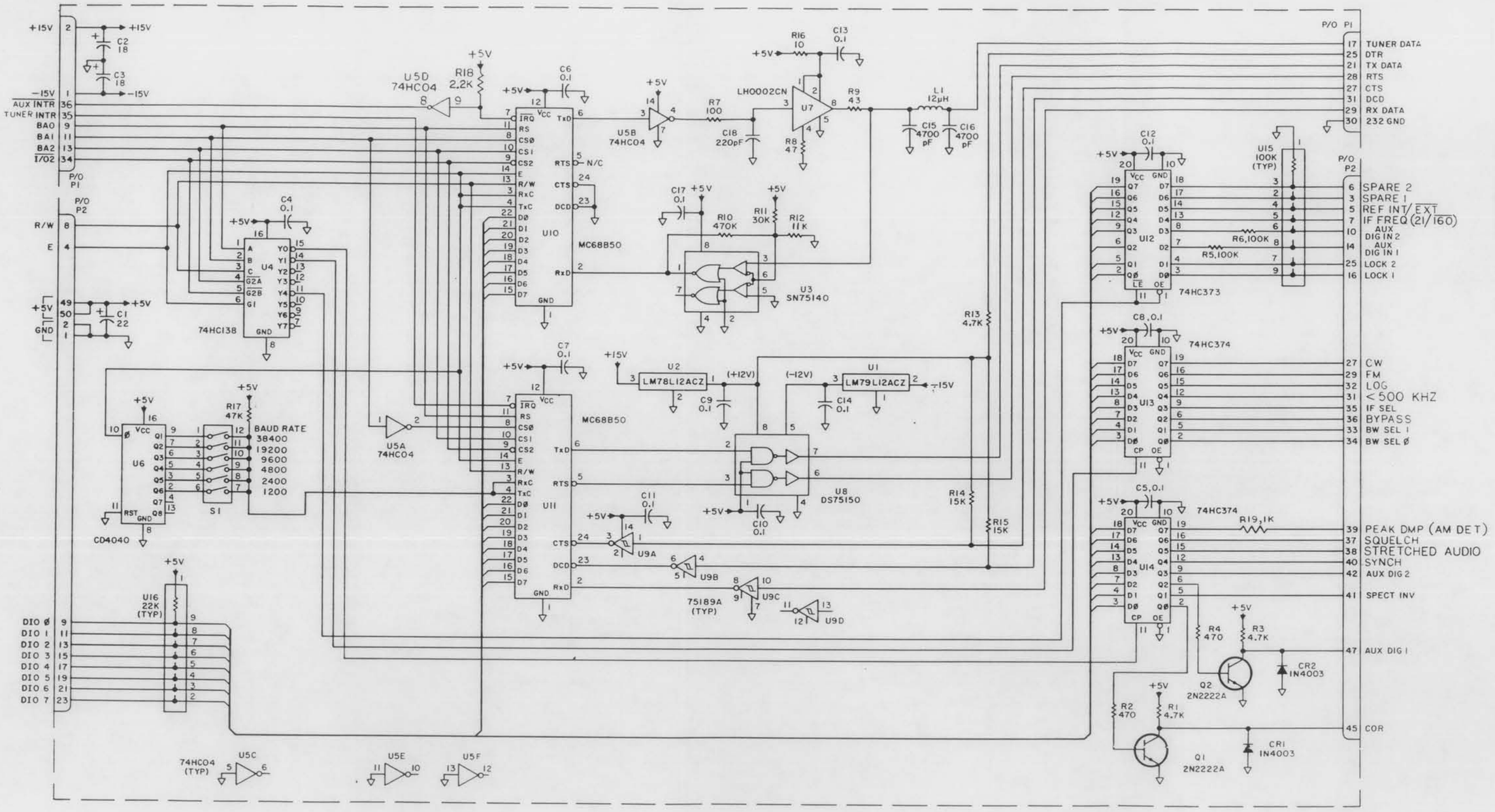
Figure 6-23. Microprocessor A5, Schematic Diagram



NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a) RESISTANCE IS IN OHMS, ±1%, 1/2W
   b) CAPACITANCE IS IN μF.

2 KEEP GNDS SEPERATE. ANALOG GND TIES TO CHASSIS.

Figure 6-24. Analog Interface A6, Schematic Diagram



NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   a. RESISTANCE IS IN OHMS, ±5, 1/4W.
   b. CAPACITANCE IS IN µF.

659508A

Figure 6-25. Digital Interface A7, Schematic Diagram

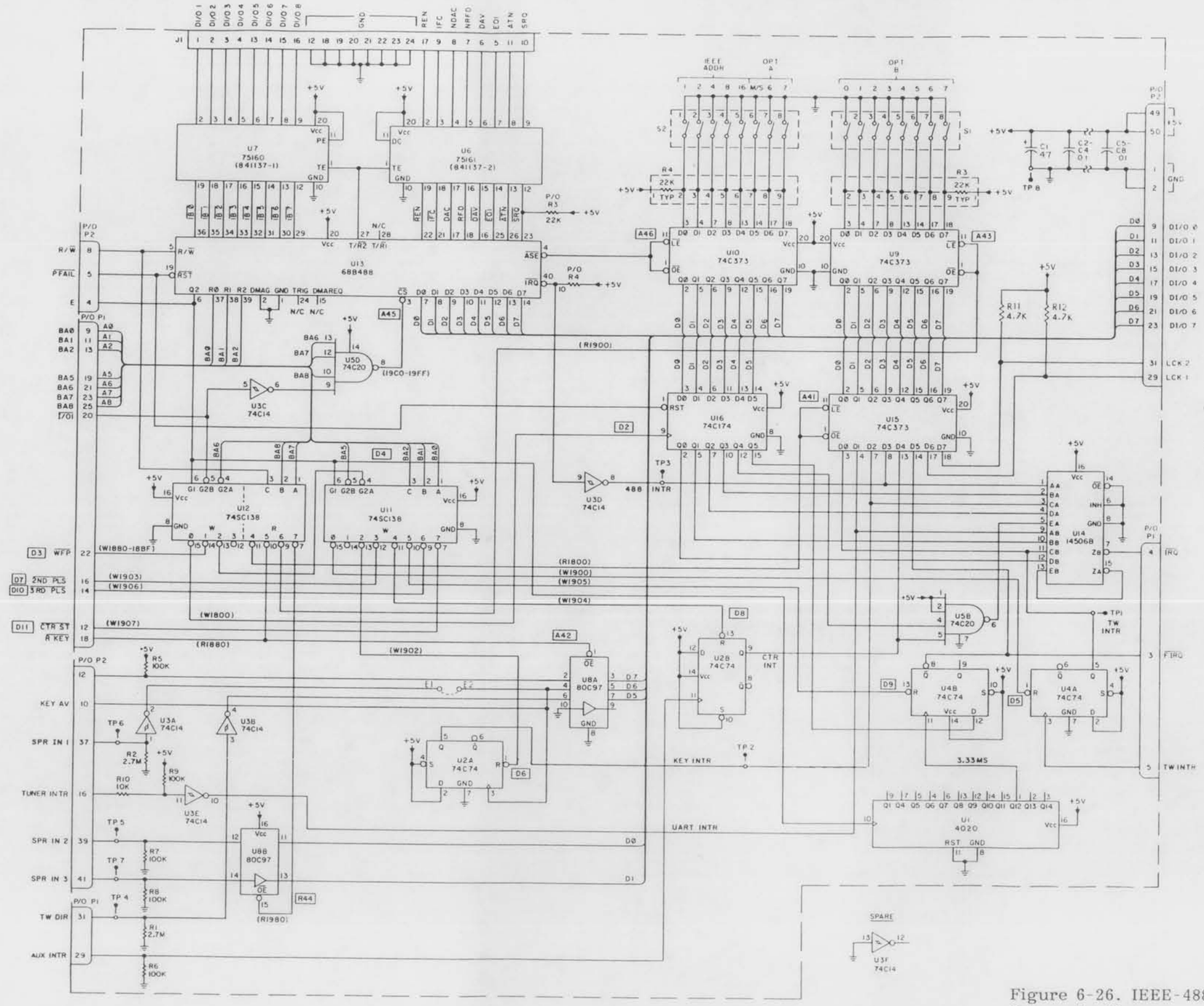
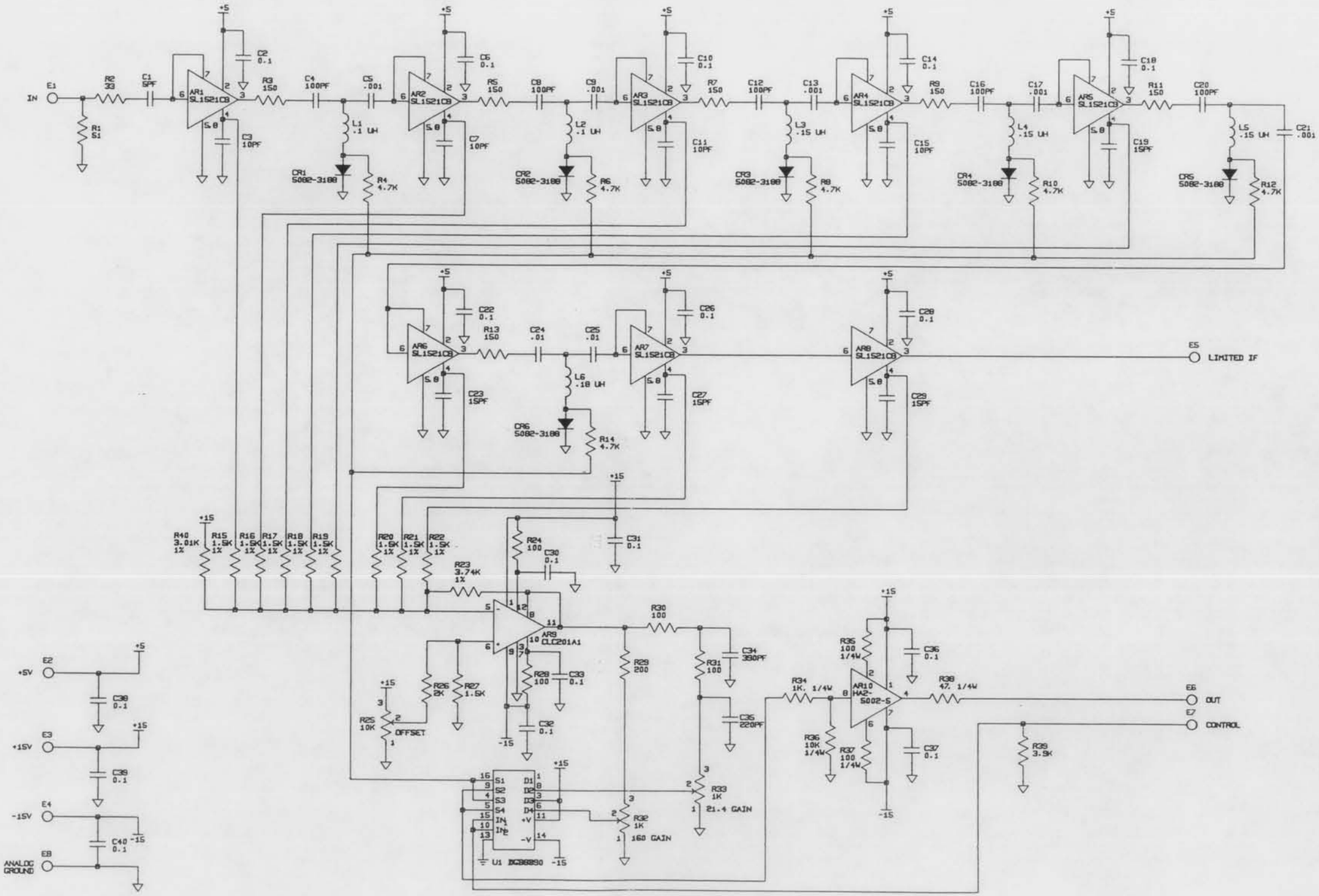


Figure 6-26. IEEE-488 Interrupt A8, Schematic Diagram



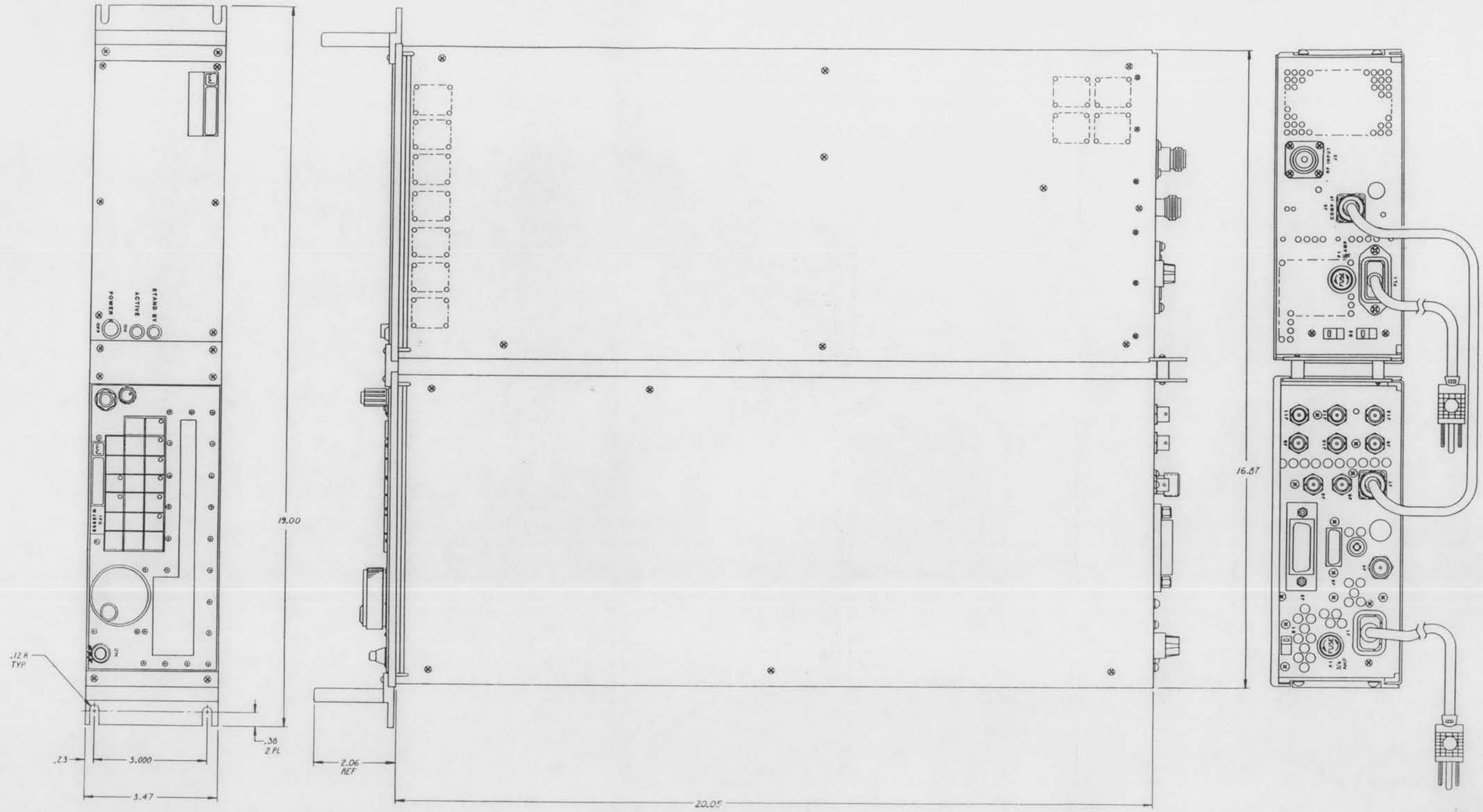
COMPONENT REF DESIG		
FIRST	LAST	DELETED
AR1	AR10	
C1	C40	
CR1	CR6	
E1	E8	
L1	L5	
R1	R40	
U1	U1	

NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL CAPACITORS ARE IN UF
2. ALL RESISTORS ARE IN OHMS, 1/8W, 5% AND 1% ARE 1/10W

660750A

Figure 6-27. Log Amplifier A14, Schematic Diagram



2. FOR SHOCK AND VIBRATION ENVIRONMENT MOUNT UNIT ON MS91405-A1D TRAY

1. CASE OUTLINE CONFORM TO MS91403-A1D

87.C.9003
(660517)

Figure 6-28. Typical WJ-8969 System Outline Drawing