INSTRUCTION MANUAL

SYNTHESIZED MONITOR RECEIVER

SMR-11

POTOMAC INSTRUMENTS, INC.

932 PHILADELPHIA AVE
SILVER SPRING, MD 20910

SYNTHESIZED MONITOR RECEIVER

MODEL SMR-11

INSTRUCTION MANUAL

POTOMAC INSTRUMENTS INC.
932 Philadelphia Avenue
Silver Spring, Maryland 20910
(301) 589-2662

WARRANTY FOR EQUIPMENT AND ACCESSORIES

Potomac Instruments Inc. warrants each new equipment to be free of defects in material and workmanship, for a period of one (1) year after date of original shipment, except for fuses, transistors, diodes, and integrated circuits, which are warranted for a period of ninety (90) days. Any instrument which is found within one year not to meet the foregoing standards after examination by our factory, will be repaired or at the option of Potomac Instruments replaced without charge. This warranty does not apply to equipment which has been altered, improperly handled, or damaged in any way.

CHANGES IN SPECIFICATIONS

The right is reserved to change the published specifications of equipment at any time, and to furnish merchandise in accordance with current specifications, without incurring any liability to modify equipment previously sold.

RETURNING EQUIPMENT TO THE FACTORY

Factory service is available for repair and adjustment of this instrument; however, a description of the trouble, plus the model and serial number(s) of the unit should be forwarded first, whereupon instructions for correcting the trouble or authorization for returning the equipment will be given. This applies to all units, whether under warranty or not. Shipment in an improper container may result in damaged equipment thereby voiding warranty.

TABLE OF CONTENTS

SECTION 4.
CIRCUIT DESCRIPTION

SECTION 5.
MAINTENANCE

SECTION 6.
DIAGRAMS

LIST OF ILLUSTRATIONS

SECTION 1
GENERAL INFORMATION

1.1 INTRODUCTION

This manual provides general and detailed information on the installation and operation procedures for the SMR-11. Section 1 contains general information and operating specifications on the SMR-11 and related equipment. Section 2 contains installation instructions, with operating procedures in Section 3. A general theory of operation is contained in Section 4, maintenance instructions are located in Section 5. The schematic and assembly diagrams are located in Section 6.

1.2 GENERAL DESCRIPTION

1.2.1 SMR-11, Synthesized Monitor Receiver

The SMR-11 is a high performance receiver specifically designed for the AM broadcast market. It features wide bandwidth, low distortion, and low noise; making it ideally suited for station monitoring and off-air performance measurements. The receiver covers the frequency range of 530 to 1700 kHz and may be locked to the desired frequency in 1 kHz steps. The front panel meter may be set to monitor the relative strength of the received signal or the peak modulation up to 150 percent. Additional features include loss of carrier and loss of audio alarms, balanced and unbalanced outputs, plus optional stereo capability and battery back-up.

The SMR-11 may be used with a variety of different antennas, including the ANT-11 or the PA-11 preamplifier available from Potomac Instruments. The SMR-11 is available in a rack-mount configuration with internal speakers or in a desk-top configuration with or without internal speakers. The rack-mount configuration is shown in Figure 1-1, the desk-top unit with the ANT-11 is shown in Figure 1-2.

1.2.2 AMS-11 CQUAM® Stereo Decoder

The SMR-11 may be equipped with an optional decoder board to recover a CQUAM stereo signal. In this configuration, the basic SMR-11 circuitry is used to recover the IF signal. A portion of the IF signal is applied to the stereo card where the L−R signal is recovered. The envelope detector in the SMR-11 recovers the L+R signal and supplies it to the stereo board. The stereo board then combines the L+R with a R−L signal to recover the right channel, and the L−R with a L+R signal to recover the left channel. The right channel signal is supplied back to the SMR-11 board for output amplfication. The stereo board provides output amplification for the left channel.

1.2.3 ANT-11, Tuneable Ferrite Rod Antenna

The ANT-11 is a constant bandwidth tuneable ferrite rod antenna covering the 0.53 MHz to 1.70 MHz frequency spectrum. The unit contains an internal RF preamplifier and is housed in an aluminum rectangular prism enclosure which serves as an electrostatic shield. Designed primarily as the receiving antenna for the Potomac Instruments SMR-11 receiver, the ANT-11 may be used for similar applications involving laboratory quality "off air" equipment.

* CQUAM is a registered trademark of Motorola Inc.

The ANT-11 may be connected to the receiver (or other RF device) by virtually any length of coaxial cable because of the internal impedance matching preamplifier. When used with the SMR-11, DC power for the preamplifier is derived from the SMR-11 power supply and fed to the antenna via the interconnecting coaxial cable. The preamplifier may be powered from an external 8 to 15 VDC source via coaxial cable or barrier strip connection.

The antenna pattern for the ANT-11 is a three dimensional figure eight exhibiting two broad lobes and two sharp nulls. The nulls occur for sources located on the long axis of the unit, and maximum response occurs for sources in a plane perpendicular to the long axis. The ANT-11 may also be used as a tuneable pre-selector for a long wire or vertical whip antenna. A 43-inch telescoping whip is supplied with the ANT-11. A customer provided long wire antenna may be connected via barrier strip terminals. Such an antenna can increase system sensitivity but eliminates the protection from noise sources provided by the electrostatic shield.

The ANT-11 is designed for indoor use but may be mounted in any convenient waterproof housing for outdoor applications. A waterproof housing (Model WP-11) is available from Potomac Instruments. For indoor use, the ANT-11 mounts on a swivel base which provides 360 degrees rotation and vertical tilting. A locking screw is provided to secure the tuning for fixed-frequency applications.

The ANT-11 preamplifier is an active, broadband impedance matching device for matching the antenna to a coaxial cable. The overall open circuit voltage gain is unity from 0.54 MHz to 1.80 MHz. Maximum output level is a function of external power supply voltage (see table in paragraph 1.3.2).

1.2.4 PA-11, Antenna Preamplifier

The PA-11 is an active, broadband impedance matching device for matching a long wire, loop or vertical whip antenna to a coaxial cable of virtually any length. The input stage of the PA-11 is a diode protected, low noise JFET transistor. The overall open circuit voltage gain is unity from 530 kHz to 1.8 MHz. Designed primarily as the antenna coupling device for the SMR-11 receiver, the PA-11 may be used for similar applications where selectivity is determined by ancillary equipment. The PA-11 is supplied with the SMR-11 as standard equipment.

Maximum output level is a function of external power supply voltage (see Specifications, paragraph 1.3.3). DC power may be supplied via center conductor of the output cable or via barrier strip connector.

The PA-11 is intended for indoor use but may be mounted in any convenient waterproof housing for outdoor applications.

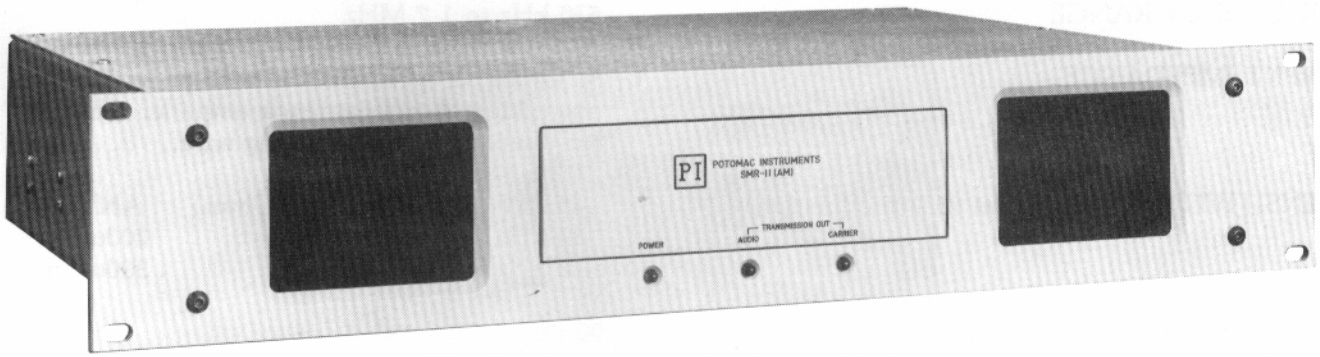


Figure 1-1. SMR, Rack Mount Configuration.

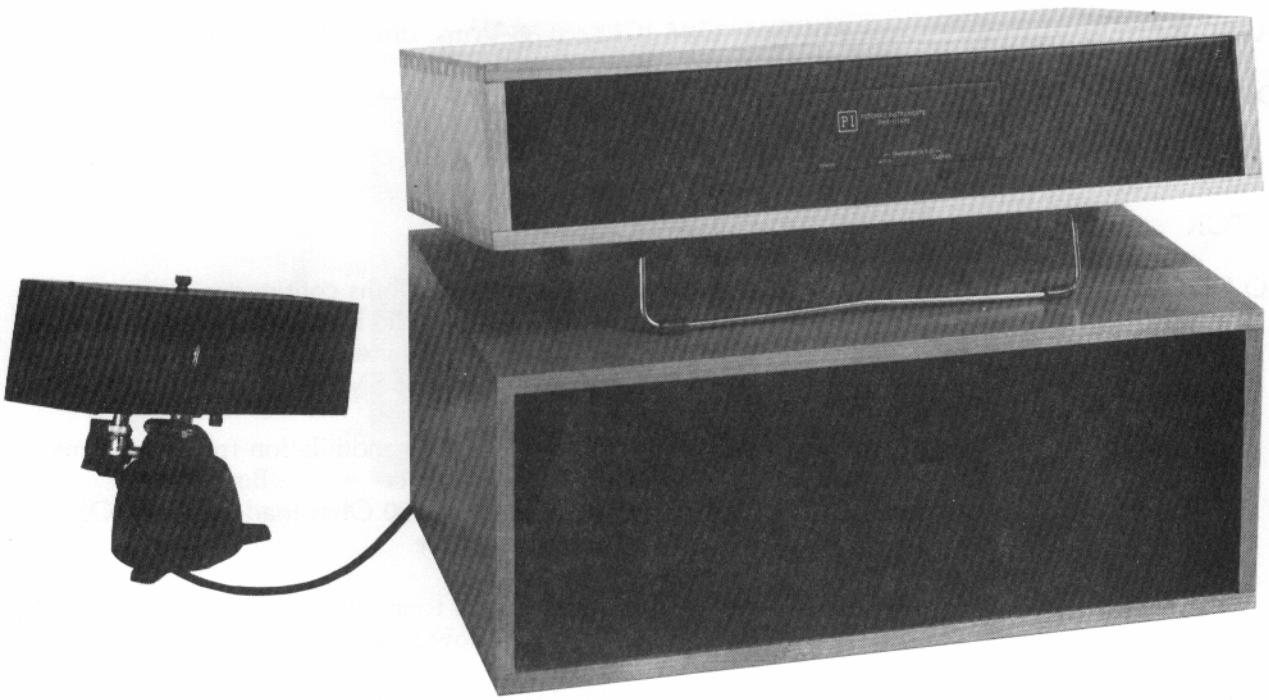


Figure 1-2. SMR-11, Desk Top Configuration with ANT-11.

1.3 SPECIFICATIONS

1.3.1 SMR-11 Specifications (monaural receiver, envelope detection only)

FREQUENCY RANGE	530 kHz to 1.7 MHz
INPUT IMPEDANCE	50 Ohms (BNC connector) with provision for powering a remote antenna amplifier. Hi Z for direct connection of long wire.

SENSITIVITY (20 dB S/N at 95% modulation)

IF BW	DIRECT (50 Ohms)	ANT-11
12 kHz	7uV	200uV/m
28 kHz	10uV	300uV/m

IMAGE REJECTION (with ANT-11)	90 dB
IF REJECTION (with ANT-11)	70 dB @ 530 kHz; 110 dB @ 800 kHz and above.
IF FREQUENCY	455 kHz (single conversion)
LOCAL OSCILLATOR STABILITY (synthesizer operation)	±0.005% (1.0 kHz steps).
DYNAMIC RANGE	To 0.35 Vrms, direct; to 2.0 V/m, ANT-11.

BANDWIDTH AND SELECTIVITY

IF BW	-3 dB	-60 dB
12 kHz	±6.5 kHz	±11 kHz
28 kHz (mono)	±14 kHz	±23 kHz

DETECTOR	Active/envelope.
AUDIO OUTPUTS	5 Watts into 4 Ohms continuous sine wave at 0.2% THD (Audio frequency response is equalized for speakers included with rack mount version of SMR-11. 3.3 Vp-p at 95% modulation from 5k Ohms unbalanced source; +3.5 dBm @ 95% modulation in 600 Ohm load from 600 Ohm balanced source. Note: Alarm tone appears in speaker output but not in low level outputs.
AUDIO FREQUENCY RESPONSE	12 kHz BW; 0.5 dB maximum variation 20 Hz to 4.5 kHz, -3 dB @ 6 kHz. 28 kHz BW; 0.5 dB maximum variation 20 Hz to 8 kHz, -3 dB @ 14 kHz.
NOTCH FILTER	Notch Depth: 40 dB @ 10 kHz or 9 kHz, may be switched out.
TOTAL HARMONIC DISTORTION (95% modulation)	0.2% maximum at audio frequencies above 40 Hz.

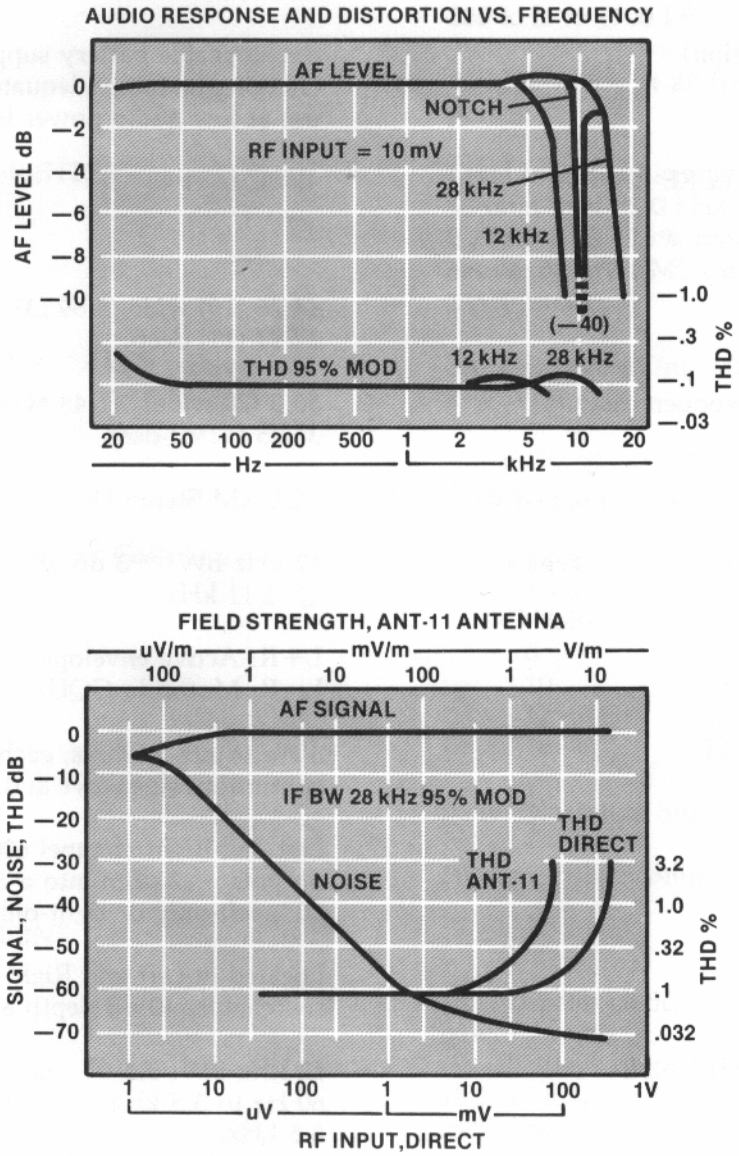


Figure 1-3. SMR11 Performance Curves.

INTERMODULATION DISTORTION (60 Hz & 7 kHz @ 4:1 ratio, 95% peak modulation)	0.4% maximum.
EXTERNAL POWER	117 ±10% VAC (230 VAC option), 50 or 60 Hz, 20 watts.
INTERNAL POWER (option)	Rechargeable battery supply with automatic charging feature; adequate for 20 hours of use at low audio power levels.
OPERATING TEMPERATURE RANGE	-20°C to +45°C.
DIMENSIONS, CM (IN)	
Rack Mount Model	48.26 (19) wide, 8.89 (3½) high, 27.94 (11) deep.
Desk Model (includes wooden case)	50.8 (20 wide), 11.43 (4½) high, 31.75 (12½) deep.

1.3.2 SMR-11 Specifications (Equipped with AMS-11 CQUAM Stereo Decoder)

BANDWIDTH AND SELECTIVITY (typical)	12 kHz BW: −3 dB @ ±6.5 kHz, −60 dB @ ±11 kHz.
DETECTOR	L+R: Active envelope detector L−R: Motorola CQUAM IC decoder.
AUDIO OUTPUTS	5 Watts into 4 Ohms, each channel, continuous sine wave at 0.4% THD.
	Left and Right channel 600 Ohms balanced outputs, −2 dBm into a 600 Ohm load for 50% left-only or right-only modulation.
NOTCH FILTER	Located in Left and Right outputs, switchable, 40 dB depth at 10 kHz or 9 kHz.
AUDIO FREQUENCY RESPONSE	12 kHz BW: 0.5 dB maximum variation, 60 Hz to 3.5 kHz; −3 dB at 35 Hz and 6.5 kHz.
	24 kHz BW: 0.5 dB maximum variation, 60 Hz to 7.5 kHz; −3 dB at 35 Hz and 12 kHz.
TOTAL HARMONIC DISTORTION (Typical, 24 kHz BW, at 600 Ohm Outputs)	0.2% @ 1 kHz, 1.0% @ 55 Hz and 4.5 kHz; for 50% left-only or right-only modulation.
INTERMODULATION DISTORTION (200 Hz and 2500 Hz; 4:1 Ratio)	1.0% Typical at 50% left-only or right-only modulation.
SEPARATION (24 kHz BW)	Greater than 30 dB, 60 Hz to 5 kHz.
SIGNAL TO NOISE RATIO (24 kHz BW)	50 dB Typical maximum for 50% left-only or right-only modulation.

1.3.3 ANT-11 Specifications

TYPE	Magnetic, coil on ferrite rod, tuneable, with preamplifier.
FREQUENCY RANGE	530 kHz to 1700 kHz.
BANDWIDTH	40 kHz ± 5% at all frequencies at -3 dB points.
OUTPUT CHARACTERISTICS	Level for a field strength of 1 V/m, with a 50 ohm load; 530 kHz: 42 mV RMS carrier, 0.27v p-p @ 125% mod.; 1100 kHz and above: 60 mV RMS carrier, 0.38v p-p @ 125% mod.
SENSITIVITY (20 dB SNR, 28 kHz receiver bandwidth; 95% mod.)	530 kHz: 270 uV/m; 1100 kHz and above: 210 uV/m.
POWER REQUIREMENT	+6 V DC @ 10 mA to +15 V DC @ 28 mA.

Maximum Level at Amplifier Overload

Supply Voltage DC Volts	Supply Current DC Milliamps	Max. Output Vp-p, 50 ohms
8	12	3
10	16	4
12	18.5	4.8
14	22	5.8

Note: Maximum Supply Voltage is 15 V DC.

Impedance	50 ohms, BNC connector.
MOUNTING DIMENSIONS	
Indoor	14″ diameter circle, 10″ high including swivel base.
Outdoor	15-3/4″ long by 8-5/8″ wide by 7-1/4″ high, excluding mount.
TEMPERATURE RANGE	-40°F to +140°F operating.

1.3.4 PA-11 Specifications

FREQUENCY RANGE	530 KHz to 1.8 MHz.
INPUT Z	82K ohms, shunted by 10pf.
OUTPUT Z	50 ohms
VOLTAGE GAIN	Hi Z load: 0 dB 50 ohm load: -6 dB
POWER GAIN	Greater than 26 dB with 50 ohm load.

ANTENNAS	Vertical Whip (43″ plug in telescoping whip supplied); Long Wire (connect to ANT terminal of barrier strip); Tuned loop (connect between GND and ANT terminals of barrier strip).
POWER REQUIREMENTS/OUTPUT VOLTAGE	

Supply Voltage DC Volts	Supply Current DC Milliamps	Max. Output Vp-p, 50 ohms
8	12	3
10	16	4
12	18.5	4.8
14	22	5.8

Note: Maximum Supply Voltage is 15 V DC

OPERATING TEMPERATURE RANGE	-40°F to +140°F.
MOUNTING DIMENSIONS	3-3/4″ by 2-5/8″ flat surface.

SECTION 2
INSTALLATION

2.1 GENERAL

This section provides detailed information on the installation procedures for the SMR-11, ANT-11, and the PA-11. It is recommended that the entire section be reviewed before attempting any installation procedures.

2.2 SITE SELECTION

2.2.1 SMR-11 Mounting

For ease of operation and of viewing the control panel, the rack-mount receiver is best mounted at eye level. The desk-top unit can be tilted to achieve this objective. Also to be considered, when the front panel speakers are used for monitoring, is sound radiation to listeners. A factor in locating the desk-top unit is convenience of bringing power and signal cables to the rear panel. Avoid locating the receiver near a heat source, or near a source of radiated RF noise such as poorly shielded digital equipment.

2.2.2 Antenna Placement

If the transmitters to be monitored provide sufficient field strength, and if there is little manmade noise at the receiver location, a long wire antenna connected directly to rear terminal 5 may give adequate performance (signal strength indication above 100 for low noise from receiver). In most cases, this is neither adequate nor convenient, and the receiver is designed to be fed by coaxial cable from a remotely located antenna. Two such devices are available.

The simplest remote antenna system uses the Type PA-11 Antenna Preamplifier fed from a wire antenna. The PA-11 is a broadband, low-gain amplifier in a small shielded box, connected to the receiver by any length of 50 ohm coaxial cable. It receives dc power from the receiver. When placed at a point of low RF noise, it can provide good performance even with a short (approximately 1 meter) wire or whip antenna. If the desired signal is weak, the antenna must be designed to prevent stronger undesired signals from overdriving the PA-11. The antenna should not allow the receiver's signal strength meter to go quite to full scale for any signal in the frequency range.

Better performance in some situations can be obtained with the ANT-11 tuneable ferrite rod antenna. The ANT-11 can also be located at a remote point to obtain maximum signal-to-noise ratio and is adjusted for maximum receiver signal strength meter indication. With its Faraday shielding it is less susceptible to noise that is more electric than magnetic. It has nulls in its pattern and can therefore be oriented to reject undesired signals. It can also be used as a tuner for a long wire antenna. This mode of operation provides high sensitivity, but with more susceptibility to noise. A weatherproof box for outdoor installation of the ANT-11 is available.

2.3 INTERFACE CONNECTIONS AND OPERATING OPTIONS

2.3.1 SMR-11

All interface connections to the SMR-11 are made to rear panel connector J201 and terminal board TB201. Interface connections are the same for both the rack-mount and the desk-top configurations. Interface connections that are unique to a receiver with a stereo card are listed below the corresponding monaural receiver connections. Figure 2-1 illustrates the pin connections for both receivers.

ANTENNA AND RF INPUTS

J201 RF IN	50 ohm RF input with dc power available. Connect the ANT-11 Antenna, PA-11 Preamplifier, or other 50 ohm source here. For the ANT-11 and PA-11, connect a jumper wire between terminals 1 and 2 of TB 201 to obtain dc power for the amplifier. For other sources, block dc voltage from the source by connecting the jumper between terminals 2 and 3. The maximum carrier input level for low distortion is 0.3 volt RMS.
TB 201 Terminals 1, 2, 3	See RF IN above. When using wire connections for a 50 ohm source, connect the signal wire to 3 and the jumper wire between 2 and 3. Connect the ground wire to 4.
4	RF circuit ground.
5	High impedance RF Input. May be used for a local long wire antenna or a higher voltage source. The maximum carrier input level for low distortion is 1.0 volt RMS.

AUDIO OUTPUTS—Monaural

13	Unbalanced output, 4700 ohm source impedance, 3.6 volts p-p at 95 percent modulation. (Not available in stereo receivers).
14	Audio circuit ground. Connect unbalanced circuit ground or cable shield here.
15, 16	Balanced output terminals, 600 ohm source impedance, +4.0 dBm output at 100 percent modulation with a 600 ohm load. Either 15 or 16 may be used as an unbalanced 300 ohm source, same output level as at 13. 16 is in phase with 13. The alarm tone voltage does not appear in these outputs. The alarm voltage can be added by means of a field modification; contact the factory for details.
17, 18, 19	Speaker connections. To use the front panel speakers, connect a jumper between 18 and 19. Connect an external speaker between 19 and 17. 17 is the low (speaker ground) terminal. Any speaker impedance above 3 ohms may be used.

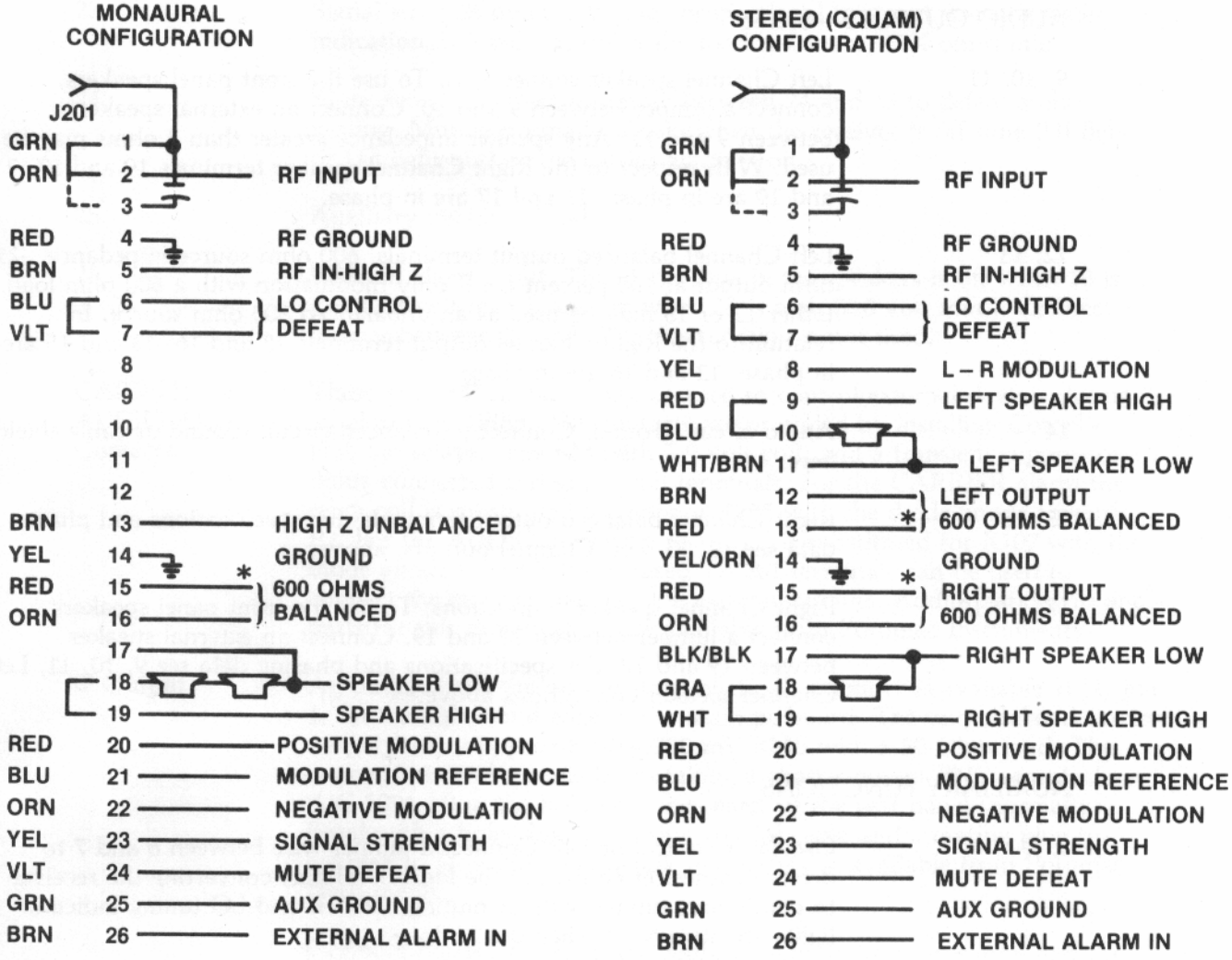


Figure 2-1. Rear Panel Connections, TB201

AUDIO OUTPUTS—Stereo

9, 10, 11	Left Channel speaker connections. To use the front panel speakers, connect a jumper between 9 and 10. Connect an external speaker between 9 and 11. Any speaker impedance greater than 3 ohms may be used. With respect to the Right Channel speaker terminals 19 and 17, 9 and 19 are in phase, 11 and 17 are in phase.
12, 13	Left Channel balanced output terminals, 600 ohm source impedance, -2.0 dBm output at 100 percent L+R only modulation with a 600 ohm load. Either 12 or 13 may be used as an unbalanced 300 ohm source. In relation to the Right Channel output terminals 15 and 16, 13 and 15 are in phase, 12 and 16 are in phase.
14	Audio circuit ground. Connect unbalanced circuit ground or cable shield here.
15, 16	Right Channel balanced output terminals; for specifications and phase data see 12, 13, Left Channel outputs, above.
17, 18, 19	Right Channel speaker connections. To use the front panel speakers, connect a jumper between 18 and 19. Connect an external speaker between 19 and 17. For specifications and phasing data see 9, 10, 11, Left Channel speaker connections above.

AUXILIARY FUNCTIONS

6, 7	Oscillator control defeat. Connect a jumper wire between 6 and 7 to defeat synthesizer control of the local oscillator, converting the receiver to continuous tuning without muting. The HI and LO tuning indicator lights are always on when this is done.
8 (Stereo)	L-R peak modulation output. A dc voltmeter between 8 and 21 indicates 500 millivolts for 50% peak L-R modulation.
20 (Monaural)	Positive peak modulation output. A dc voltmeter between 20 and 21 indicates +1.0 volt for 100 percent positive peak modulation; load resistance, 10K ohms min.
20 (Stereo)	Positive L+R peak modulation output. A dc voltmeter between 20 and 21 indicates 500 millivolts for 50 percent positive envelope modulation.
21	Modulation reference output.
22 (Monaural)	Negative peak modulation output. A dc voltmeter between 22 and 21 indicates -1.0 volt for 100 percent negative peak envelope modulation; load resistance, 10K ohms min.
22 (Stereo)	Negative L+R peak modulation output. A dc voltmeter between 22 and 21 indicates 500 millivolts for 50 percent negative envelope modulation.

23	Signal strength output. Voltage proportional to signal strength meter indication, 5.0 volts at full scale; load resistance, 10K ohms min.
24	Mute defeat. Connect a jumper between 24 and 25 to defeat audio muting. Muting normally occurs when the receiver is off tune (HI light or LO light out) or the carrier alarm is on.
25	Auxiliary circuit ground.
26	External alarm input. The alarm tone in the speakers is off when 26 is low (0.3 volt max.), and on when 26 is high (2.0 volt min.). Connect a jumper between 26 and 25 if this function is not used.
CARRIER and AUDIO Alarm Contacts	These optional contacts may be used to control external devices during an alarm condition. The contacts are provided by installing Cornell-Dubilier relays, type 603 with a 9 volt coil, and a transient suppressor diode connected across the coil terminals. For the CARRIER alarm the relay coil is substituted for resistor R105 with the diode anode towards P2. For the AUDIO alarm the relay coil is substituted for R107 with the diode anode towards P3. Unused TB 201 terminals can be used to connect the relay contacts to the external circuits. Additional details and parts for this modification are available from Potomac Instruments.
IF Output	An output from the output stage of the IF amplifier is available at J4, pin 1, on the right hand edge of the main pc board. The unmodulated carrier output level is approximately 120 mV RMS with a 50 Ohm load. The connection can be made by installing a chassis-mount BNC receptacle (UG-1094/U) in the hole near the center of the rear panel (normally fitted with a hole plug) and using coaxial cable and a mating plug to connect to J4. Additional details and parts are available from Potomac Instruments.
—	Optional Battery Saver. If the SMR-11 is on battery operation and the internal speakers are not being used, the battery life may be extended by removing power from the output amplifier. This is accomplished by disconnecting P16 from J16. If the stereo board is used, disconnect P315 from J15.
AC Power 117 or 230 VAC	AC Power input. Check that the input voltage marked on the receiver matches the available supply voltage before making this connection.
Chassis Ground	A stud and thumbscrew for direct grounding of the chassis is provided at the left side of the rear panel.

OPTIONAL MODES AND OUTPUTS (AMS-11 board only)

On the AMS-11 CQUAM stereo decoder board some functions and outputs are available which are not brought out to an external terminal, as described in the following paragraphs.

Force To Stereo	The decoder can be forced into the stereo mode, whether or not the 25 Hz pilot tone is present, by grounding AMS-11 board terminal pad E 14 (U1 pin 15). The stereo lamp will be on whenever E 14 is grounded.
Force To Monaural	The decoder can be forced into the monaural mode at all times by grounding AMS-11 board terminal pad E 16.

L+R Audio Output — An L+R audio output is available on the board at terminal pad E 19 through a 10μ F coupling capacitor. The output is unbalanced, has a maximum level of approximately 2 V peak-to-peak, and requires a minimum load impedance of 600 Ohms. If a high load capacitance (750 pF) is used, a series resistor of at least 470 Ohms should be connected at E 19 to prevent oscillation.

L−R Audio Output — An L−R audio output is available on the board at terminal pad E 18 through a 10μ F coupling capacitor. Refer to the L+R audio output described above for signal specifications and restrictions.

2.3.2 External, Line Powered Preamplifiers

The SMR-11 will provide optimum performance when it is used with an external preamplifier, such as the PA-11, an antenna with a built-in preamplifier, such as the ANT-11, or similar devices. The SMR-11 provides a dc voltage at the rear panel terminal strip to power the external devices through the coaxial cable. If this is not desireable, the external device may be powered with a separate power supply. Figure 2-2 illustrates a suggested configuration for connecting the external supply.

2.3.3 Modifications for 450 kHz IF

The SMR-11 IF frequency is 455 kHz and the IF filters are centered at 455 kHz. The synthesizer can be modified to produce an IF of 450 kHz by connecting a jumper between main pc board terminal pads E11 and E12 (near the two 24-pin ICs). For optimum results the RF alignment should be corrected if this option is used.

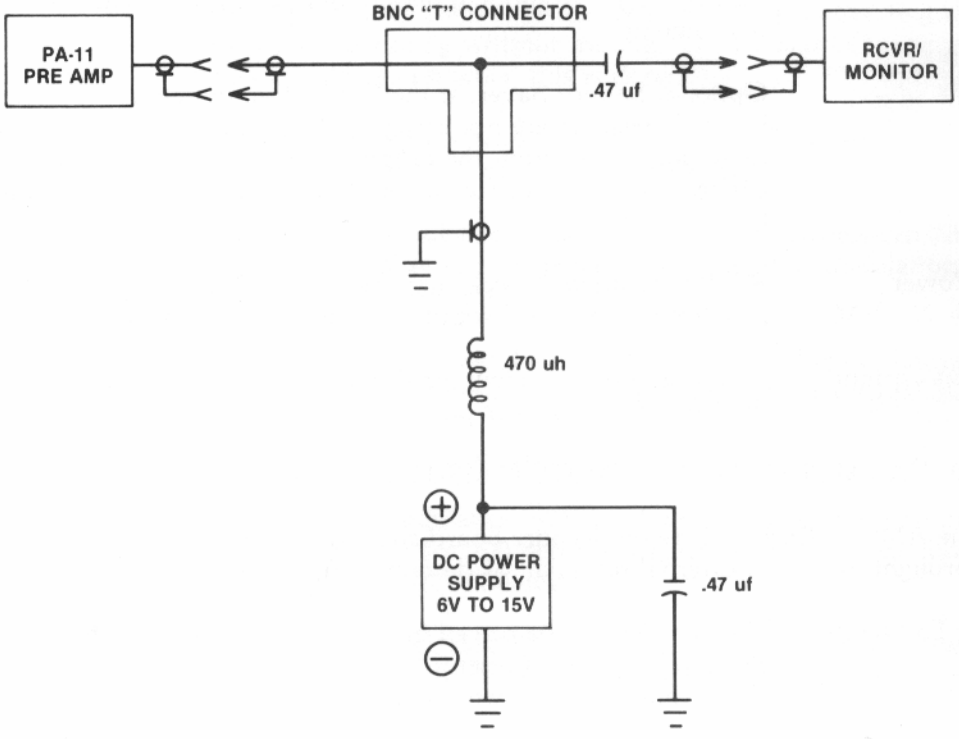


Figure 2-2. Typical Wiring Configuration for External Power Supply

SECTION 3
OPERATION

3.1 GENERAL

This section contains a description of the operating controls and indicators for the SMR-11 and a general description of the typical operating procedures. The exact operating procedures are dependent on the operating configuration and the intended use of the receiver.

3.2 OPERATING CONTROLS AND INDICATORS

Figure 3-1 illustrates the controls and indicators located behind the blank access panel. The following paragraphs provide a description of their function.

POWER Switch
POWER Light

Turn the POWER switch ON to apply power to the receiver. The POWER light should then light. The alarm will be heard for a short time if an input signal is present and continuously if there is no signal at the tuned frequency (see ALARM controls).

NOTE: Power is always applied to the battery charger and audio amplifier whenever the AC power line is connected.

Tuning Controls:
Dial
Thumbwheels
HI & LO Light
Stereo Light

To tune the receiver to a desired frequency, using the synthesizer, first set the frequency into the thumbwheel switches so that they show the frequency in kilohertz. Then adjust the dial to that frequency, going higher if the LO light is on or lower if the HI light is on; the dial setting is correct when both lights are on. Set the dial to the center of the range over which both lights stay on. No audio will be heard until both lights are on. If the alarm tone comes on and remains on, see ALARM functions below.

The receiver may be converted to continuous tuning, without synthesis or muting, by connecting a jumper between rear panel terminals 6 and 7. When tuning from station to station in this mode, the carrier loss alarm may be frequently triggered; this can be prevented by adjusting the C potentiometer CCW, which disables the carrier alarm.

If the received signal is in CQUAM stereo with its 25 Hz pilot present and the AMS-11 Stereo Decoder is installed, the ST (Stereo) indicator light should come on within a few seconds.

SPKR Switch

Adjust for the desired sound level from the speakers. Loudness compensation is provided. The SPKR switch does not control the alarm tone sound level (see ALARM below).

ALARM MUTE Switch
A potentiometer
C potentiometer
CARRIER light
AUDIO light

The alarm tone is heard if the carrier level drops below a preset level (CARRIER light on) or if the modulation drops below 10 percent for more than 30 seconds (AUDIO light on). If this occurs, the tone can be stopped by pressing the ALARM MUTE pushbutton. The lights will stay on until the fault is corrected. If contact closure on Alarm operation is desired, please refer to paragraph 2.3.1.

Adjust the A potentiometer for the desired alarm tone loudness (independent of SPKR switch setting). Adjust the C potentiometer for the desired carrier alarm threshold.

If the external alarm function (rear terminal 26, see paragraph 2.3.1) is used, an alarm condition is indicated by the tone without lights.

NOTCH IN/OUT Switch

Set the NOTCH switch to IN to insert a notch filter at the carrier beat frequency (10 kHz or 9 kHz, set internally). The beat frequency attenuation is greater than 30 dB; signal attenuation is small 1 kHz below the beat.

METER Switch
METER

Set the METER switch to MOD to read peak positive modulation percentage to 150 percent. The meter circuit transient response is compensated for overshoot caused by the IF filter to improve measurement accuracy on program material.

Set the METER switch to SS to read relative signal strength. For high signal-to-noise ratio and low distortion, a reading between 100 and 140 is desirable.

BW Switch (rear panel)

Set the BW (bandwidth) switch to the desired IF filter bandwidth, 12 kHz or 28 kHz. The 28 kHz filter plugs in internally and is easily replaced with other bandwidths.

3.3 TYPICAL OPERATING PROCEDURES

3.3.1 Operation with Synthesizer Frequency Lock

In most applications, where the frequency of the signal to be monitored is known, the synthesizer is used to lock the LO to the frequency. In this mode, the jumper must be removed from pins 6 and 7 on the rear panel terminal strip TB201.

Enter the desired frequency, to the nearest 1 kHz, using the thumbwheel switches. If the LOW indicator is on, adjust the tuning dial to a higher value; if the HIGH indicator is on turn the dial to a lower value. When both indicators are on the LO is locked to the synthesizer. Adjust the dial to the mid-position in the range when both indicators are on.

3.3.2 Continuous Tuning Operation

For continuous tuning operation install the jumper between pins 6 and 7 on the rear panel to defeat synthesizer control of the LO. Both tuning indicators will remain on in this mode. Turn the front panel C control fully counterclockwise to disable the loss of carrier alarm. The SMR-11 may now be used as a standard receiver to scan the broadcast band.

3.3.3 Alarm Operation

An audible alarm will be present in the internal loudspeakers if a loss of carrier or loss of audio condition occurs; or if an external alarm is present. The loss of carrier or audio alarm will also light front panel indicators. An audible alarm with both indicators off indicates that an external alarm is present.

Front panel adjustment C is used to set the carrier alarm threshold. Turning the adjustment fully counterclockwise will disable the alarm. Front panel adjustment A is used to adjust the loudness of the alarm signal. Turning the adjustment clockwise increases the loudness. The audible alarm may be muted by depressing the alarm mute pushbutton. This will inhibit the audible alarm. The associated indicator lamps will remain on indicating that an alarm condition is still present. When the alarm condition is cleared the indicator lights will go out and the mute pushbutton will be reset for the next alarm condition.

3.3.4 Stereo Reception

When receiving a CQUAM stereo signal it may be found that the SMR-11 occasionally switches to monaural operation for several seconds, with the ST light out, and then returns to stereo operation. This can be caused by a physical jolt, which produces an RF phase disturbance because of the mechanical tuning capacitor used. It may also be due to electrical noise or co-channel interference, because the decoder integrated circuit includes circuits which detect co-channel interference and, when it exceeds a preset level, will switch the IC to monaural operation. The AMS-11 decoder can be forced to remain in the stereo mode at all times by grounding terminal pad E14 on the AMS-11 board. Refer to paragraph 2.3.1 for additional information.

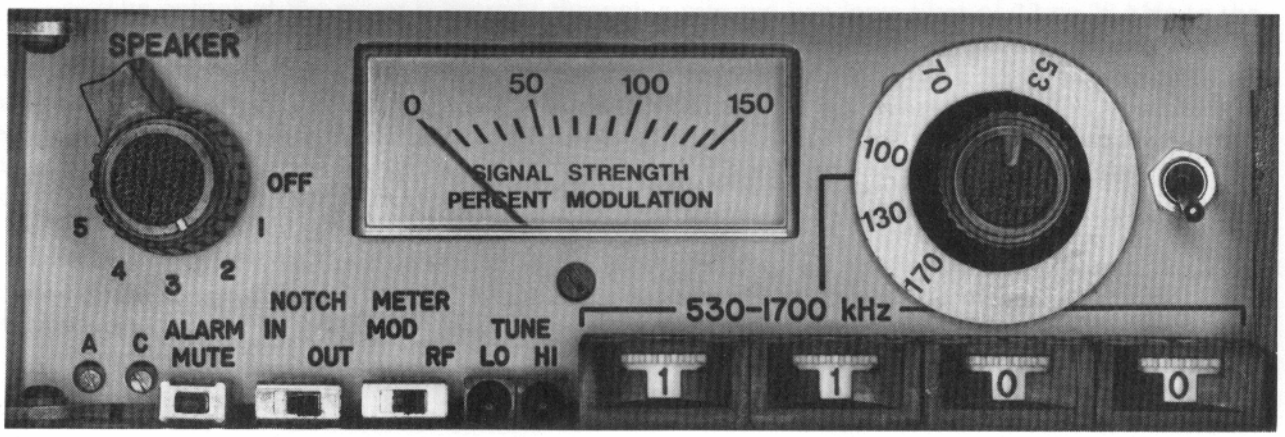


Figure 3-1. Operating Controls and Indicators, Monaural Receiver Shown

SECTION 4
CIRCUIT DESCRIPTION

4.1 GENERAL

This section contains a general description of the principal circuits contained in the SMR-11 and the AMS-11 CQUAM stereo decoder board. The SMR-11 circuitry is shown in Figure 6-1, the stereo decoder is shown in Figure 6-2.

4.2 SMR-11 RECEIVER

4.2.1 Block Diagram Description

The SMR-11, synthesized monitor receiver, is a high performance receiver specifically designed for the AM broadcast market. It features wide bandwidth, low distortion, and low noise; making it ideally suited for station monitoring and off-air performance measurements. The SMR-11 may be used with a variety of different antennas, including the ANT-11 or the PA-11 preamplifier available from Potomac Instruments.

Figure 4-1 is a simplified block diagram of the principal circuits contained in the SMR-11. The RF input signal is brought through the preselector, amplified and applied to the mixer. The front panel variable tuning control is used to tune the bandpass of the preselector and the frequency of the local oscillator. The synthesizer circuit, set with the thumbwheel switches to the exact frequency, is used to lock the local oscillator to the tuned frequency. The LO signal, 985 to 2155 kHz, is combined with the received signal, 530 to 1700 kHz, to produce an IF of 455 kHz.

The output of the mixer is brought through a selected bandpass filter of 12 or 28 kHz to the IF amplifier. The output of the amplifier is filtered and applied to the detector, used to recover the audio. A front panel control is used to switch the notch filter in or out of the circuit. The notch filter is used to suppress the carrier beat frequency resulting from the adjacent channel spacing. The center frequency of the notch filter is set at 10 kHz for US applications or 9 kHz for European applications. The output from the filter is applied to the internal speaker amplifier and to the output amplifier providing a 600 Ohm balanced output.

A portion of the detector output signal is brought through an amplifier to generate the AGC signal. The AGC signal is also brought to the front panel meter and alarm circuits. The tuning indicator circuits provide a high/low indication of the tuned frequency compared to the frequency set with the thumbwheel switches.

4.2.2 RF and Audio Circuits

If the ANT-11 or the PA-11 is used the RF input signal is brought through J201, as shown in Figure 6-1. A jumper between pins 2 and 3 on TB201 will route the signal to transformer T1. The high impedance primary on T1 provides a direct input for a long wire antenna through pin 5 on TB201. The secondary of T1 is connected to the double-tuned preselector. Coupling between the tuned circuits is controlled by tuning inductance of coil L2, also controlled by the main tuning capacitor. Loading resistors R1-R4 and R5 produce circuit Q proportional to frequency, resulting in a constant 40 kHz bandpass over the entire tuning range.

The output signal from the preselector is brought through RF amplifier Q1/Q2 to double-balanced mixer U1. The mixer combines the tuned frequency with the LO signal of 985 to 2155 kHz to produce the 455 kHz IF. The SMR-11 may also be operated with an IF of 450 kHz, as described in Section 2. Mixer U1 provides two outputs, on pins 6 and 12. The outputs are connected to filters FL1 (28 kHz) and FL2 (12 kHz). In the monaural receiver these filters are ceramic ladder filters with a low shape factor (60 dB BW/3 dB BW ratio) and noticeable passband ripple. In the stereo receiver the wide filter is an LC filter with a higher shape factor but very low passband ripple and better linearity. This provides higher separation and lower distortion at high audio frequencies. Rear panel switch S203 is used to select the filter by forward biasing diodes CR2 or CR3. Filter FL1 is a plug-in filter and may be substituted with any customer supplied filter.

The output from the selected filter is brought to the IF amplifier consisting of transistors Q3 through Q7. The gain of the IF amplifier is controlled by PIN diodes CR4 through CR9. The current through the diodes is determined by the AGC signal from U3D. A higher AGC current will decrease the resistance through the diodes to decrease the amplifier gain. Variable resistor R149 is used to minimize the distortion through the amplifier. The output from the IF amplifier is filtered through L11 and C38, amplified through Q8 and Q9, and applied to the detector. The detector is an active design, functioning as an operational amplifier (Q10 and Q11) with a diode (CR11) in the feedback path. This technique provides a very linear detector with low distortion.

The half-wave rectified signal from the emitter of Q11 is applied to an active filter consisting of U3C and related components. The output of the filter is brought to the mute switch, transistor Q12. This switch is used to block the audio signal if the LO is not locked to the synthesizer or if a carrier alarm is present. This feature may be disabled (switch always closed) by connecting a jumper between pins 24 and 25 on TB201. The output of Q12 is brought to a second switch, Q18. This switch is used to bypass the notch filter when the front panel notch switch is set to the out position. The notch filter, consisting of U14A and related components, is used to suppress the carrier beat frequency resulting from the adjacent channel spacing. Variable resistors R129 and R132 are used to set the center frequency of the filter at 10 kHz for US standards or 9 kHz for European applications.

The output from the notch filter is brought through audio amplifier and U14D to the front panel speaker switch S202. U14D is an active filter providing a broad peak at 80 Hz rolloff above 10 kHz to compensate for speaker characteristics. A stepped control is used so that both channels may be set to the same loudness level when the stereo option is used. Each step decreases the audio level by approximately 8 dB. Capacitors C202 and C203 provide a bass boost at low settings for loudness compensation. The output from the speaker switch is brought through driver U15 to the output stage Q20 and Q21, used to drive the internal speakers. When the internal speakers are used a jumper must be connected between pins 18 and 19 on TB201. If the internal speakers are not used, plug P16 may be removed to conserve battery life.

The audio signal is also avalable as balanced and unbalanced outputs. The output of U14B is brought directly to pin 13 of TB201 as a high Z output. The audio signal is inverted through U14B and again through U14C to provide a balanced output at pins 15 and 16 of TB201.

4.2.3 LO and Synthesizer Circuits

The SMR-11 is normally tuned by first setting the thumbwheel switches to the desired frequency and then tuning the LO until it locks on that frequency. This is accomplished by comparing the output of the synthesizer with a fixed reference and using the difference between the two signals as a control voltage for the local oscillator.

The synthesizer consists of U7 through U13 and related components. U7 and U8 are programmable divide by N counters. U8 is set with the thumbwheel switches, S4 through S7, to divide by the selected frequency. U7 is preset to divide by 455. The LO signal, through Q28, is used as the clock input to both dividers.

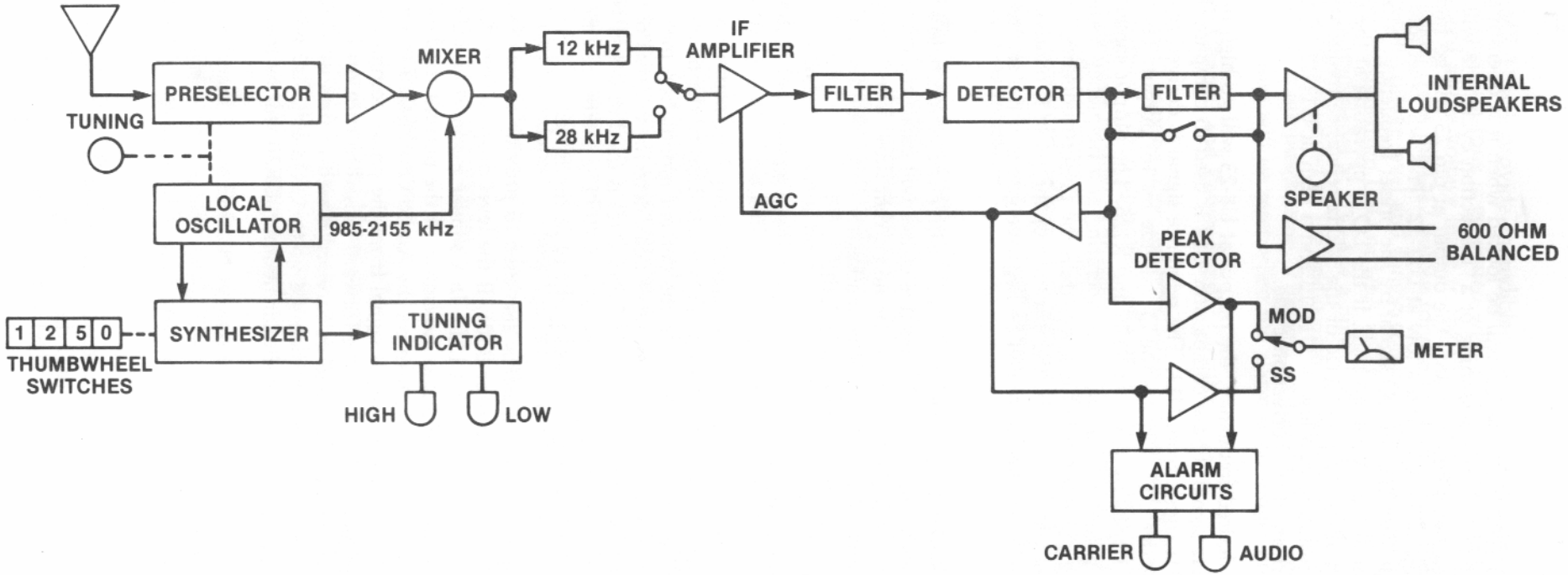


Figure 4-1. Simplified Block Diagram, SMR-11 Monaural Circuitry

If the selected frequency is 1000 kHz, the LO will be locked when it is operating at 1455 kHz; or 455 kHz above the selected frequency. At the beginning of a "correction cycle" U8 will be disabled and U7 will be enabled. When U7 reaches a count of 455, the output at pin 23 will go high to set flip-flop U11. This will result in a high at U11-13 and a low at U11-12. This will reset and inhibit U7 and enable U8. U8 will now begin dividing the LO signal by the preset frequency. After the counter has counted down to one, the output at U8-23 will go high. If the LO is operating at the preset frequency, this will occur after one millisecond (one cycle of the 1 kHz reference frequency). The high from U8-23 will reset flip-flop U11, resulting in a low at U11-13 and a high at U11-12. This will reset and inhibit U8 and enable U7 to start another "correction cycle."

If the LO is locked to the desired frequency, the output at U8-23 will go high once every millisecond; which is equal to a 1 kHz signal. Phase comparator U12 is used to compare the 1 kHz signal from U8 with a reference 1 kHz signal from U13. The reference signal is derived from the 16 kHz crystal used as the clock input to divider U13. Pin 7 is the Q4 (divide by 16) output. The output from the phase comparator is biased at 5.3 volts by resistors R125 and R126. The output signal from the phase comparator will be a positive-going pulse if the LO is operating at a frequency higher than the preset frequency, or a negative-going pulse if the LO is lower than the preset frequency. If both signals are at the same frequency but are not phase coherent, the duration of the pulse is relative to the phase angle. If the set frequency lags the reference the pulse will be negative-going, if the set frequency leads the reference the pulse will be positive-going.

The LO control circuit consists of U5, R88, and C56. Positive correction pulses will cause the current to flow in one direction through R88 and C56; negative pulses will cause the current to flow in the opposite direction. If both signals are locked there will be no current flow. The LO correction signal from U5 is brought into the LO through resistor R112. The synthesizer correction feature may be disabled by connecting a jumper between pins 7 and 6 on TB201.

4.2.4 Meter, Indicator and Alarm Circuits

The front panel meter may be set to display either signal strength or percent modulation. In the signal strength mode the AGC signal from U3D is brought through U3B to the meter. The signal strength is also present as an output on pin 23 of TB201. In the percent modulation mode the output of the positive peak detector is supplied to the meter. The positive peak detector consists of U4A and U4B, and meter drivers Q13 and Q14. A similar circuit, U4C and U4D is used to detect the negative peaks. Both signals are available as outputs on TB201, pins 20 and 22. The meter may be set to display the negative peaks by a hardware modification to connect pad E19 to the meter.

The signal strength level applied to the meter is also used to provide a loss of carrier indication. This is accomplished with U6D and resistor R101. If the level drops below the preset value established by R101, U6D will turn on the Carrier Out LED. In a similar manner the output from the positive peak detector is used to provide a loss of audio indication. If the percent modulation is less than 10 percent for more than 30 seconds, U6A will turn on the Audio Out LED. The high and low tuning indicators are controlled by the correction output signal from the phase comparator. If the tuned frequency is lower than the preset frequency CR16 will be forward biased to turn on DS1. If the tuned frequency is higher than the preset frequency CR17 will be forward biased to turn on DS2. If the correction voltage at the output of U6B or U6C is greater than 4.4 volts, CR18 or CR19 will be forward biased, turning Q12 off to mute the audio signal. In a similar manner, CR30 will be forward biased when a loss of carrier alarm is present.

The SMR-11 will provide an audible tone through the speakers during a loss of carrier or loss of audio alarm. The alarm tone is generated with a VCO located in the phase comparator, U12. A 3.9 Hz signal is used as the voltage input to the VCO, causing it to switch on and off at that rate. The 3.9 Hz signal is taken from the Q12 output (divide by 4096) of divider U13. The frequency of the tone is determined by the voltage level and timing components R120 and C60. When an alarm condition occurs the positive output from U6D or U6A will turn on Q17. The resulting low at the collector will enable U12. The output signal at U12-4 is a pulsed tone. The signal amplitude may be adjusted with R121. The alarm signal is added to the audio path through R152. The audible alarm may be disabled by pressing the alarm mute pushbutton. This will set flip-flop U11, resulting in a high at U11-1 to inhibit U12. The flip-flop will be reset when the alarm is no longer present.

4.2.5 Battery Charger and Power Supply Circuits

The SMR-11 may be operated from either a standard 115/230 volt ac source or from an optional internal battery. When operating from an ac source the power source is brought through T1 to U17, wired as a full-wave rectifier. The output of the rectifier, at 23.4 volts, is filtered by C81 and C82 and applied to the internal speaker driver circuits. The signal is also brought through Q24 to the power regulator circuits. Transistor Q26 is used to regulate the output at 10.7 volts. The dc amplifiers U16C and U16D are used to control Q26. Variable resistor R190 is used to adjust the voltage, diode CR25 provides a 6.9 volt bias reference.

When the receiver is operated from the internal batteries the +12 volt output is brought through the front panel switch to the power regulator circuits. The 12 volt signal is also brought through diode CR29 to the internal speaker driver circuits. Note that when operating on batteries only the maximum distortion-free output of the internal speakers is reduced since the drivers are operating at 12 volts instead of 23.4 volts. To prevent damage to the battery due to excessive discharge, the SMR-11 will automatically switch itself off if the battery voltage drops below a preset level. This is accomplished with U16B. If the voltage at pin 6 drops below 6.9 volts, U16B will turn on causing U16C to turn on and switch Q26 off. This will remove operating power from the rest of the SMR circuits.

When an internal battery is installed and the unit is connected to an ac source the battery charger circuits, Q22, 23 and 25, will maintain the charge on the battery. If the charge on the battery is very low the charger circuits will operate as a constant current source. As the charge on the battery increases, the circuit will switch to a constant voltage, or trickle, charger. In the constant current mode the charging current is limited to approximately 400 milliamperes. The voltage drop across R170 will cause Q23 to turn on to control the base current to Q22. As the battery becomes charged, the voltage drop across R170 will be reduced, turning Q23 off. The Q22 base current will now be controlled by Q25. Variable resistor R177 is used to adjust the charging voltage in the constant voltage mode.

4.3 CQUAM STEREO OPTION

4.3.1 Block Diagram Description

Figure 4-2 is a simplified block diagram of the principal circuits contained in the CQUAM stereo decoder card, AMS-11. The IF signal from the main board is brought through amplifier Q1 to the stereo decoder circuit, U1. The L−R output from U1 is brought through a filter and the mute switch to phase inverter U2C to produce a R−L signal.

The main board in the SMR-11 is used to recover the L+R signal, which is brought through a high pass filter to summing amplifier U4C. The second input to the amplifier is the R−L signal. The two left signals cancel, resulting in the right channel output which is brought back to the main SMR-11 board.

The output from U2C is inverted a second time through U4A to produce a L−R signal. This signal is combined with the L+R signal through U4B to derive the left channel signal. The left signal is brought through the notch filter and amplifier U5D to output driver U6. Amplifiers U5B and U5C provide a balanced output for the left channel signal.

The output from U2C is inverted a second time through U4A to produce a L−R signal. This signal is combined with the L+R signal through U4B to derive the left channel signal. The left signal is brought through the notch filter and amplifier U5D to output driver U6. Amplifiers U5B and U5C provide a balanced output for the left channel signal.

4.3.2 Decoder and Audio Circuits

The schematic diagram for the CQUAM decoder board is shown in Figure 6-2. When the stereo option is used the basic SMR receiver is used to provide the right channel audio output, the stereo board provides the left. Integrated circuit U1, shown in Figure 6-2, is a complete stereo decoder. However, in this application, only the R-L output is used.

The IF signal from test point 3 on the main card is applied to the emitter of common base amplifier Q1. The bias at the base of Q1 is an AGC voltage from U1. Resistor R5 is used to adjust the signal level at TP1 to 600 millivolts p-p with no modulation. The IF signal is brought into U1 on pin 3.

Coils L1 and L3 and related components form a 900 or 910 kHz trap (twice the IF frequency) for the internal detectors which are part of the on-chip distortion reduction circuits. Balance adjustment R7 is used to reduce distortion. Transistor Q2, an active low-pass filter with a cut off frequency of approximately 25 Hz, and related components are used to detect the 25 Hz pilot tone and co-channel interference. The L-R signal from U1-11 is the input to the filter. Variable resistor R14 is used to adjust the bandpass pilot tone filter to 25 Hz. The co-channel interference input is on pin 12. Pin 13 is the pilot tone filter input to an internal op-amp; pin 14 is the filter output and pilot tone detector input. When the pilot is present the signal at TP2 will be 25 Hz at approximately 0.5 volts p-p. This signal is applied to the PLL control and to the R-L bandpass filter to cancel any 25 Hz component that may be present.

When the 25 Hz pilot is present and the co-channel interference is below the threshold level, pin 15 will go to ground causing the stereo LED to light. The ground will also turn on Q4, removing the audio mute. Crystal oscillator Y1 and related components provide a reference frequency to the internal PLL to lock it to the IF frequency. The circuit must be phase locked for proper operation since the internal phase detectors are used to decode the L−R audio. If the circuit is not phase locked the audio and pilot signals will not be present. The oscillator operates at 8 times the IF frequency. Note that the valued of Y1, L2 and R27 are dependent on the IF frequency. Variable resistor R25 is a balance adjustment for the phase detector.

The R-L signal from U1-20 is brought through an active bandpass filter using U2A, with a frequency response of 25 Hz to 22 kHz. The output from U2A is applied to the audio mute switch, Q4. The switch will be open if a stereo signal is not present, the receiver is off-tune, or if a carrier alarm is present. When the switch is closed the R-L signal is brough through U2C to summing amplifier U4C. The other input to the amplifier is the L+R signal from the envelope detector on the main board. The signal from pin 2 of P311 is brought through U4D to summing resistor R45. The -L and +L signals cancel, resulting in the right channel audio signal at U4C-8. This signal is brought back to the main SMR board for output amplification.

The R-L signal from U2C-8 is brought through phase inverter U4A resulting in a L-R signal at U4A-1. This signal is added to the L+R signal, from U4D-14, in summing amplifier U4B. The +R and -R signals cancel, resulting in the left channel audio signal at U4B-7.

Variable resistors R22 and R40 are used to control the gain through U2C and U4A. These adjustments are made by using a right only signal and adjusting the left for 0, and then reversing the procedure.

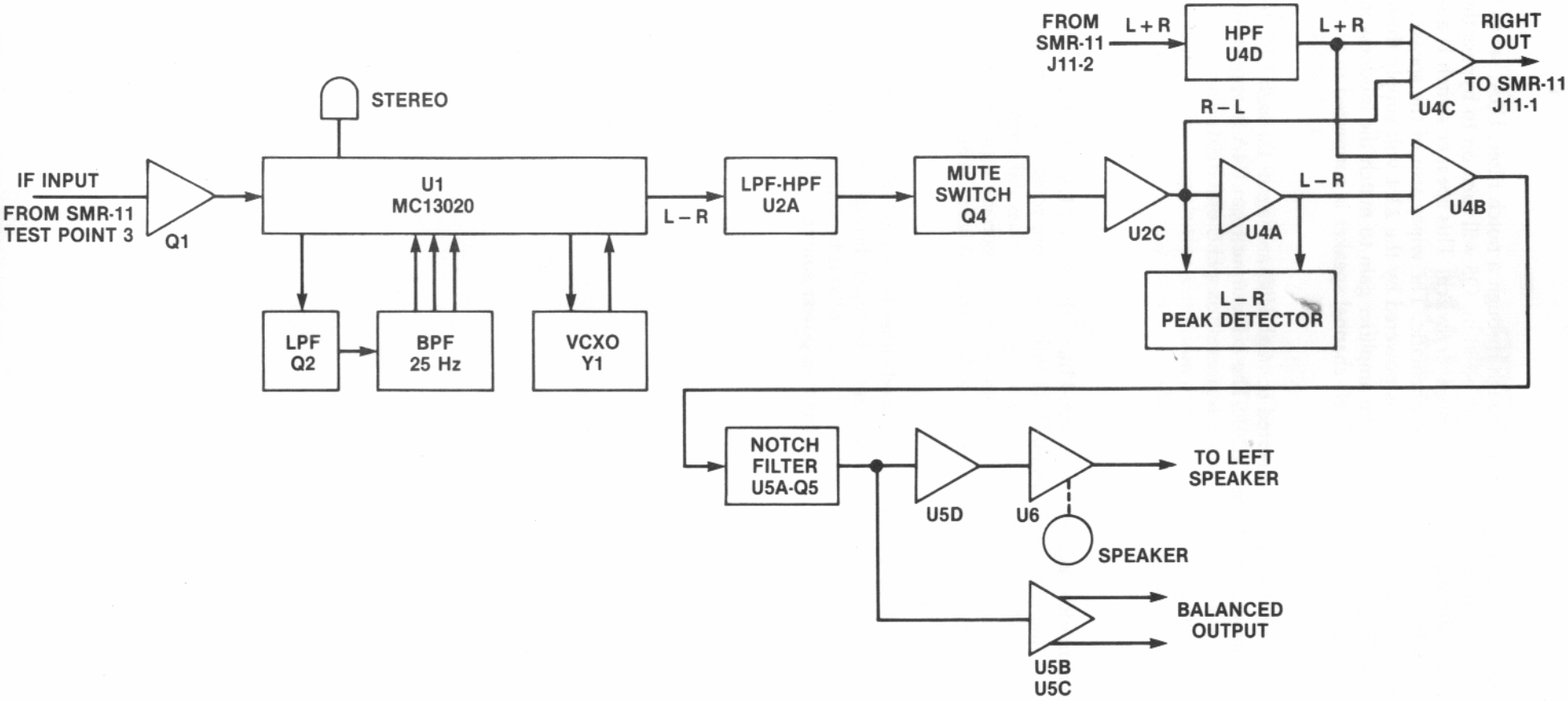


Figure 4-2. Simplified Block Diagram, CQUAM Decoder

The left channel audio signal from U4B is brough through a notch filter, U5A, set to 9 kHz or 10 kHz. If the rear panel filter switch is set to the out position, Q5 will turn on to bypass the filter. The output from U5A is brought through U5D to the speaker switch. This speaker switch is a second deck on the speaker switch shown on the main board schematic. The wiper arm of the speaker switch is brought to the speaker driver circuit U6. This circuit is powered by the 23.4 volt supply through pin 2 of P315. Variable resistor R74 is used to adjust the amplifier gain to match the loudness in the right channel from the main SMR board. The internal left channel speaker is connected to pins 9 and 11 on TB201.

The left channel output from U5A is inverted through U5B and again through U5C to provide a balanced output on pins 12 and 13 of TB201. The L-R output from U4A is applied to peak modulation detector U3C, U3B, and U3D. The output is present on pin 8 of TB201.

4.4 PA-11 and ANT-11

Figure 6-3 is the schematic diagram for the PA-11 and the ANT-11. In a PA-11 unit L7 is connected to the base JFET Q1 and ground. In an ANT-11 unit C8 is connected to Q1 and ground. The output signal from Q1 is brought through capacitors C3 and C4 to the class AB output driver, Q2 and Q3. The first stage in each section is used to bias the second stage. A feedback signal is brought through C2 to maintain unity gain across the operating spectrum of 0.53 to 1.70 MHz. The output signal is brought through capacitor C5 to connector J2.

Both the PA-11 and the ANT-11 may be powered either from the SMR-11 or from a separate external power supply. If the SMR-11 is used the dc voltage is brought through the RF output line to L6. If an external power supply is used the positive voltage (9 to 15 volts) is brought through terminal board TB1 to CR2. Diodes CR1 and CR2 are used to isolate the two power sources.

SECTION 5
MAINTENANCE

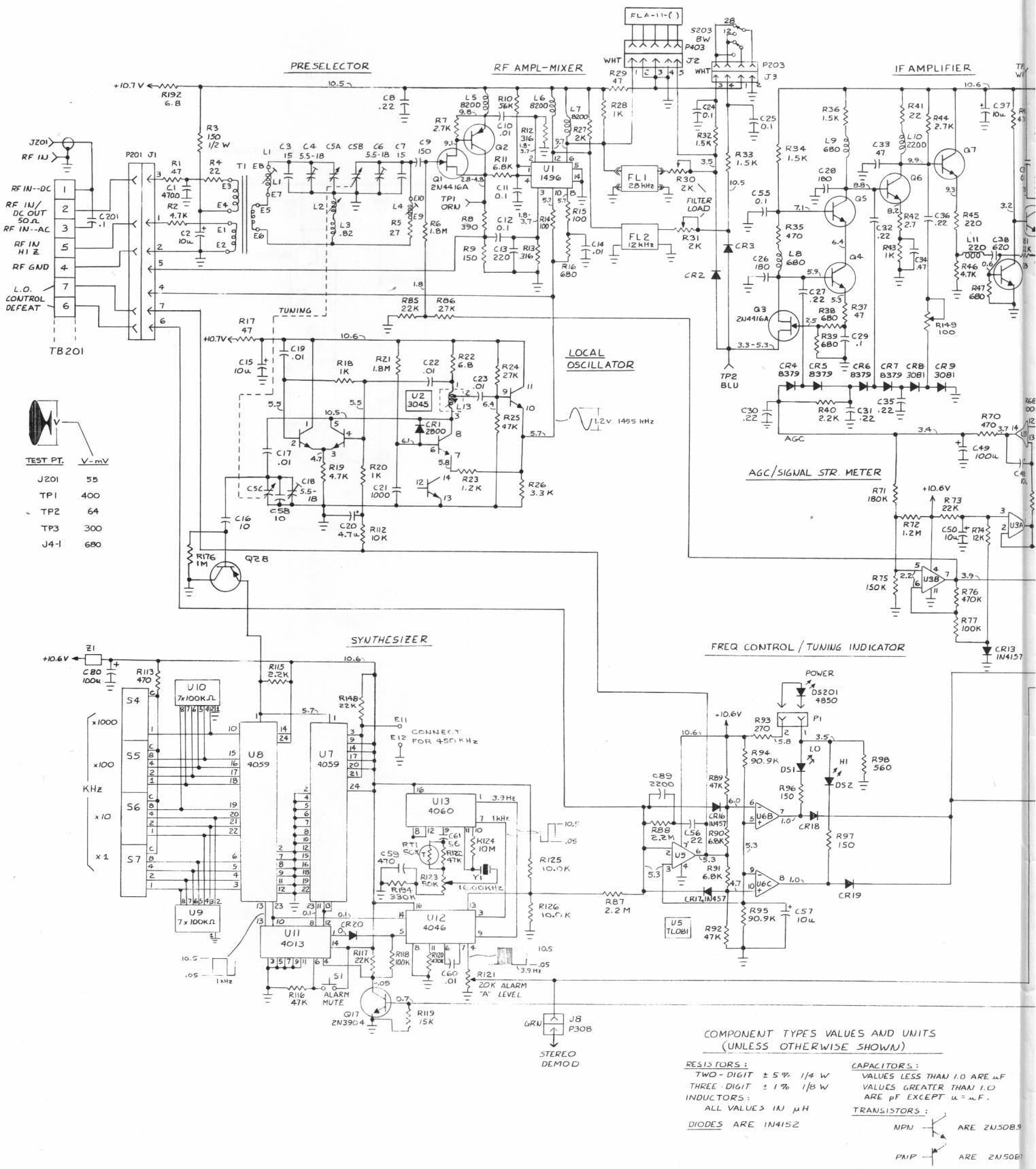
5.1 GENERAL

The SMR-11, and the optional AMS-11 decoder board, do not require any preventive or periodic maintenance. If a malfunction should occur, the defective component may be isolated by using standard troubleshooting procedures. The schematic diagram for the main board, Figure 6-1, indicates the voltage levels and signals that should be present during normal operation. Note the receiver switch settings, listed in Figure 6-1, that were used when the voltage measurements were obtained.

SECTION 6
DIAGRAMS

6.1 GENERAL

This section contains the schematic diagrams for the SMR-II (monaural), the CQUAM decoder, and the PA-II/ANT-II units.



COMPONENT TYPES VALUES AND UNITS
(UNLESS OTHERWISE SHOWN)

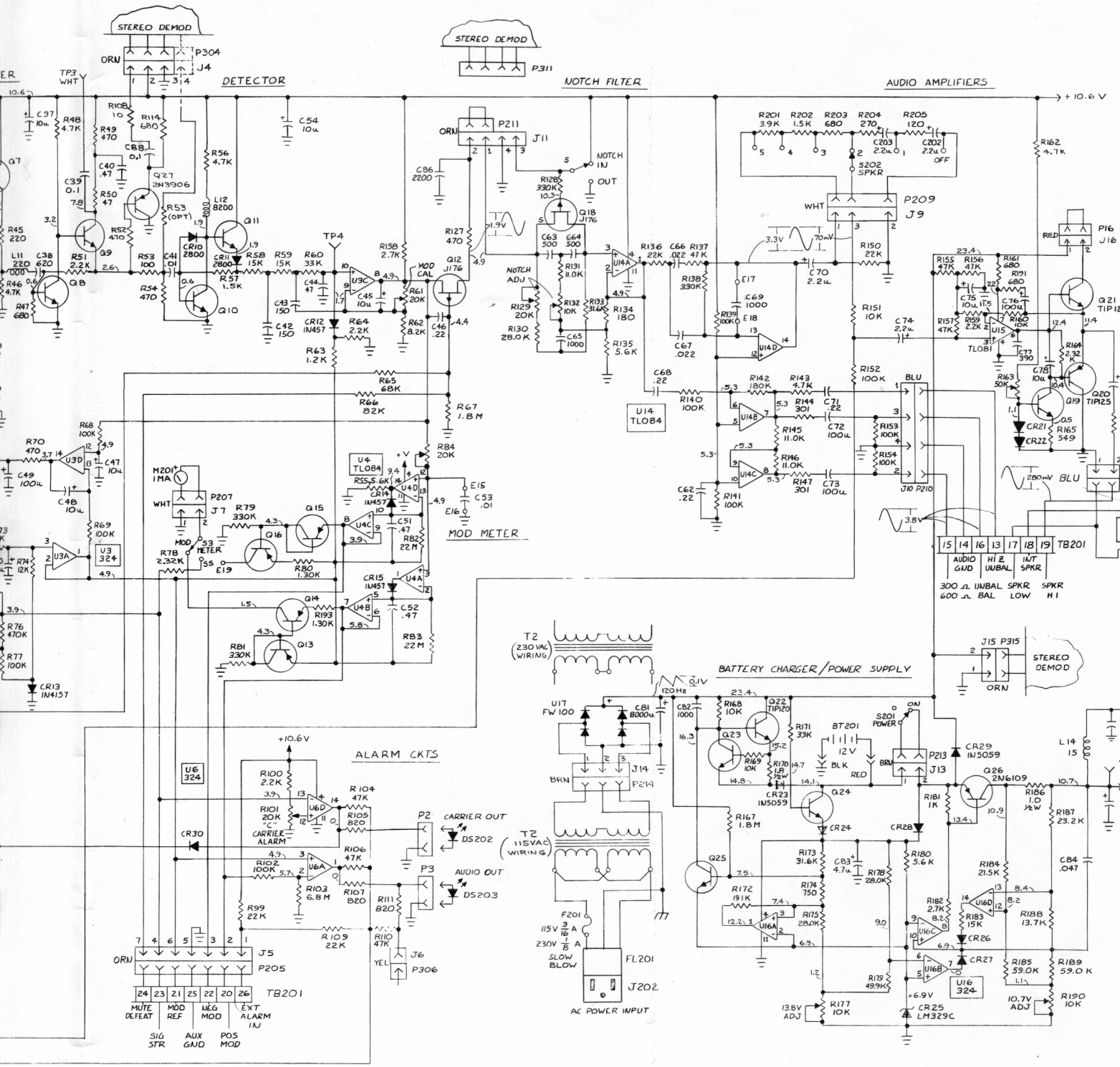
RESISTORS :
TWO-DIGIT ± 5% 1/4 W
THREE-DIGIT ± 1% 1/8 W

INDUCTORS :
ALL VALUES IN μH

DIODES ARE 1N4152

CAPACITORS :
VALUES LESS THAN 1.0 ARE μF
VALUES GREATER THAN 1.0 ARE pF EXCEPT u = μF.

TRANSISTORS :
NPN ARE 2N5089
PNP ARE 2N5087



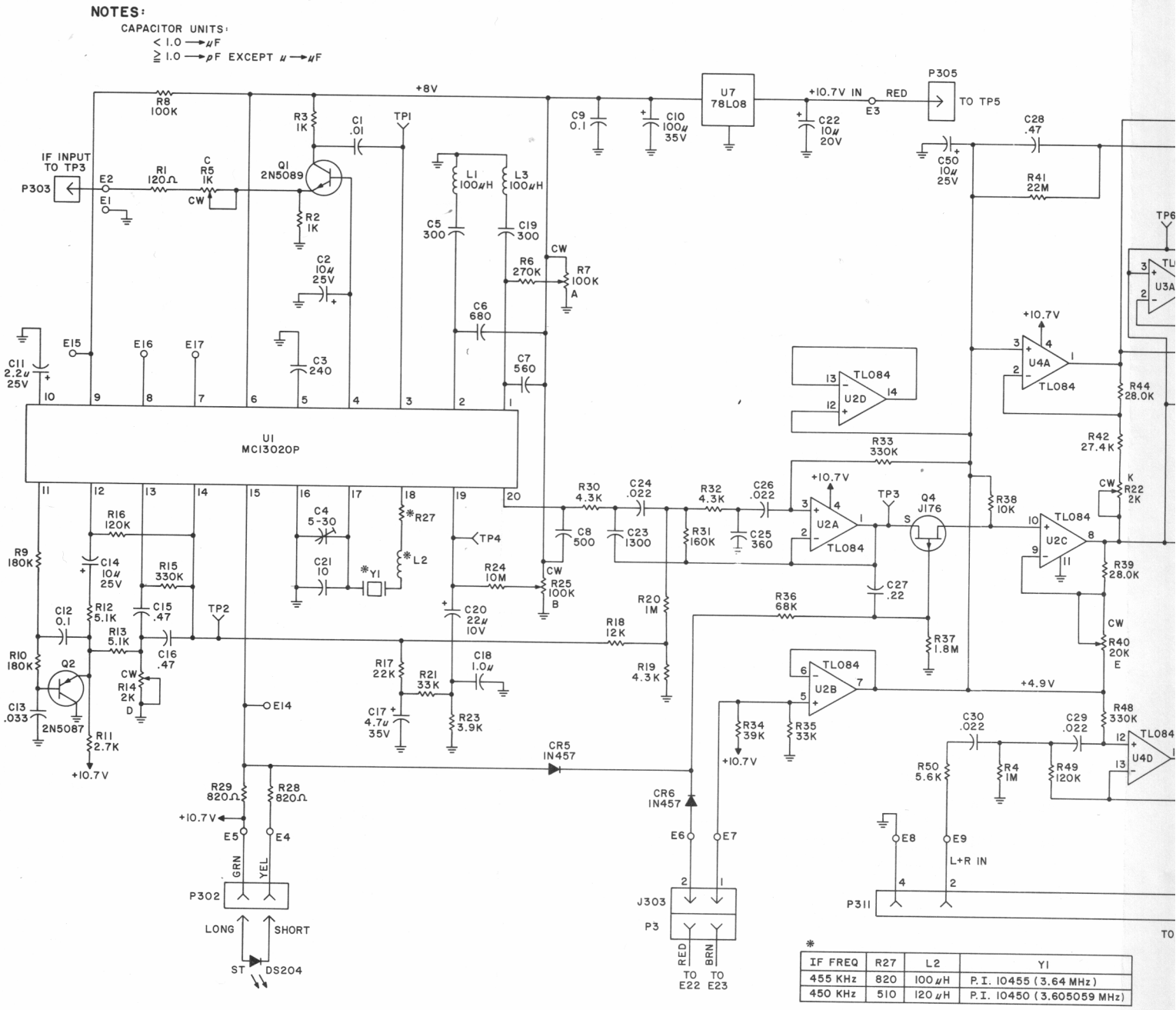
CONDITIONS FOR INDICATED VOLTAGES AND WAVEFORMS

AC POWER INPUT : 117V, 60 HZ
RF INPUT : 10mV RMS, 95 % MODULATION AT 1 KHZ FROM SIGNAL GEN.
AT J201 @ 1000 kHz, WITH JUMPER BETWEEN TB201 TERMS. 2 & 3.
SPKR : 1
EXT ALARM (TB201-26) OPEN CKT. (ALARM ON)
NOTCH: IN
METER: MOD
BW: 28 kHz
DC VOLTMETER INPUT RESISTANCE, 10 MEGOHMS, WITH 22kΩ RESISTOR AT PROBE TIP FOR AC ISOLATION
VOLTAGES ARE IN VOLTS, POSITIVE TO GND, UNLESS OTHERWISE SHOWN.

REV D 7/11/83

10.6
20K PIN 3

Figure 6-1. Schematic Diagram, SMR-11 (monaural)


NOTES:
CAPACITOR UNITS:
< 1.0 → μF
≧ 1.0 → pF EXCEPT μ → μF
+8V
R8 100K
R3 1K
C1 .01
TP1
C9 0.1
C10 100μ 35V
U7 78L08
+10.7V IN
E3
RED
P305
TO TP5
C22 10μ 20V
C28 .47
C50 10μ 25V
R41 22M
IF INPUT TO TP3
P303
E2
E1
R1 120Ω
C R5 1K
CW
Q1 2N5089
R2 1K
L1 100μH
L3 100μH
C5 300
C19 300
C2 10μ 25V
R6 270K
CW
R7 100K A
C6 680
C7 560
C11 2.2μ 25V
E15
E16
E17
C3 240
U1 MC13020P
TP6
U3A
+10.7V
U4A
TL084
R44 28.0K
R42 27.4K
U2D
TL084
R33 330K
+10.7V
R30 4.3K
C24 .022
R32 4.3K
C26 .022
U2A
TL084
TP3
Q4 J176
S
R38 10K
CW
K R22 2K
U2C
TL084
R39 28.0K
C4 5-30
C21 10
*Y1
*L2
*R27
TP4
R24 10M
CW
R25 100K B
C8 500
C23 1300
R31 160K
C25 360
C27 .22
R9 180K
R16 120K
C14 10μ 25V
R15 330K
C12 0.1
R12 5.1K
C15 .47
TP2
R13 5.1K
C16 .47
C20 22μ 10V
R20 1M
R36 68K
R18 12K
R37 1.8M
CW
R40 20K E
R10 180K
Q2
CW
R14 2K D
C13 .033
2N5087
R11 2.7K
+10.7V
R17 22K
R21 33K
C18 1.0μ
C17 4.7μ 35V
R23 3.9K
R19 4.3K
TL084
U2B
+4.9V
R34 39K
R35 33K
+10.7V
R48 330K
C30 .022
C29 .022
TL084
U4D
R50 5.6K
R4 1M
R49 120K
CR5 IN457
E14
R29 820Ω
R28 820Ω
+10.7V
E5
E4
GRN
YEL
P302
LONG
SHORT
ST
DS204
CR6 IN457
E6
E7
J303
P3
RED
BRN
TO E22
TO E23
E8
E9
L+R IN
P311
TO
*
IF FREQ | R27 | L2 | Y1
455 KHz | 820 | 100 μH | P.I. 10455 (3.64 MHz)
450 KHz | 510 | 120 μH | P.I. 10450 (3.605059 MHz)

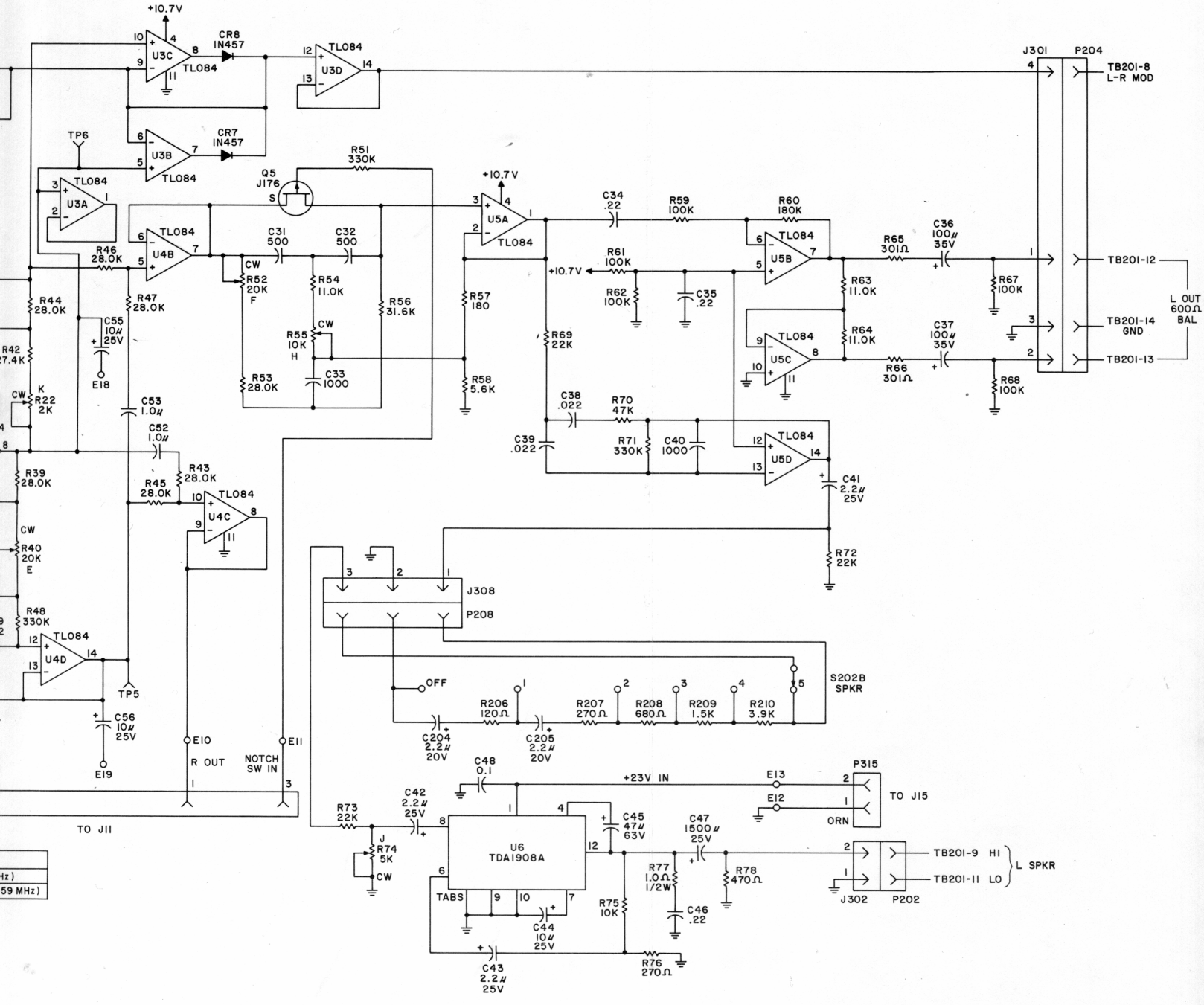
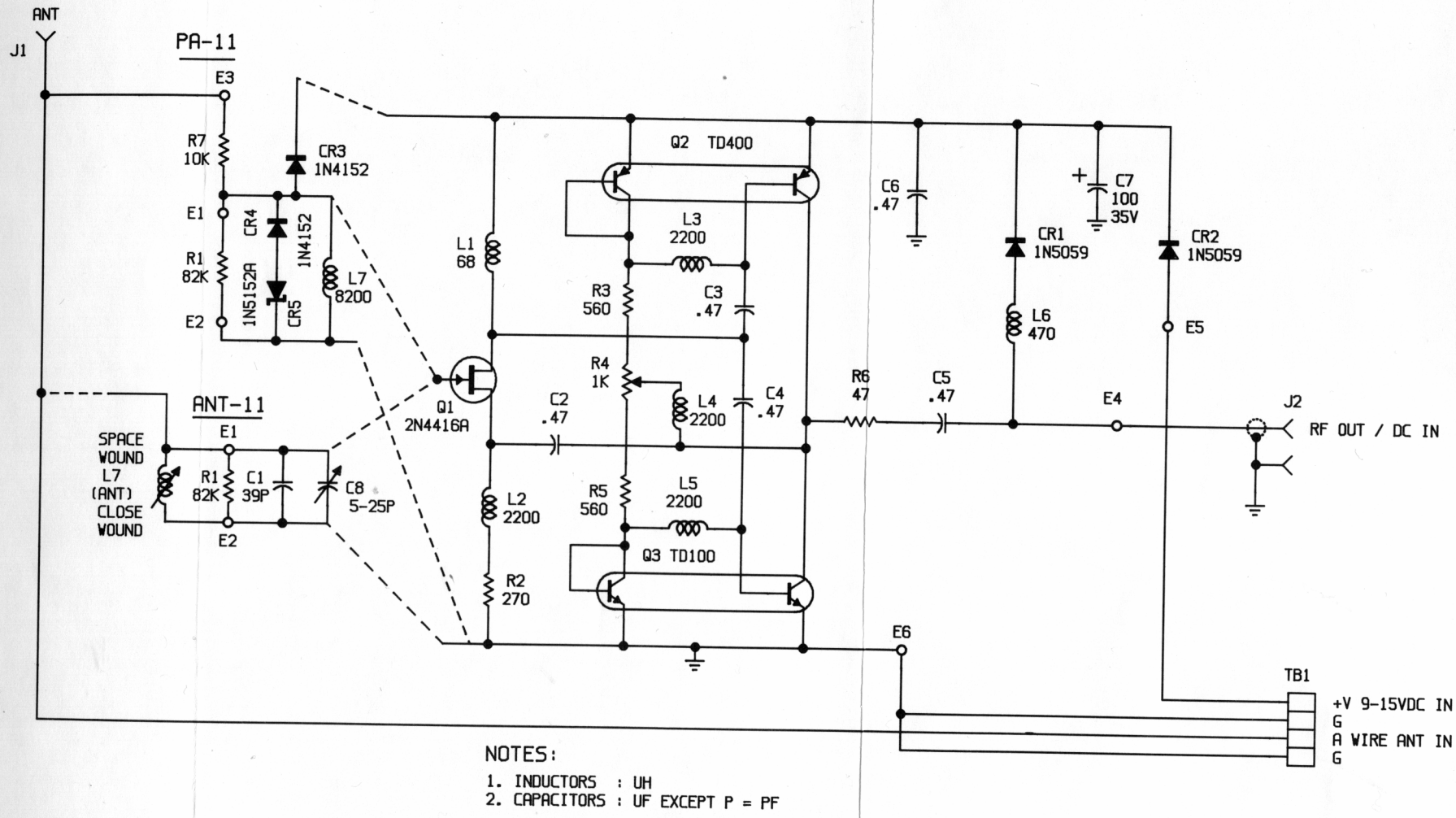


Figure 6-2. Schematic Diagram, CQUAM Decoder



NOTES:

1. INDUCTORS : UH
2. CAPACITORS : UF EXCEPT P = PF