Model AMM-3V
AM MODULATION MONITOR
Voice of America

Guide to Operations

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All Belar products are warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery, FOB factory or, in the case of certain major components listed in the instruction manual, for the specified period. Belar will repair or replace products which prove to be defective during the warranty period provided that they are returned to Belar prepaid. No other warranty is expressed or implied. Belar is not liable for consequential damages.

For any assistance, contact your Belar Sales Representative or Customer Engineering Service at the Belar factory.

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(SPECIAL MODIFIED VERSION)

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SECTION 1

GENERAL INFORMATION

1-1 GENERAL DESCRIPTION

The Belar AMM-3 AM Modulation Monitor, (FCC Type Approval #3-231) is an all solid state precision AM demodulator designed to meet the Federal Communications Commission requirements for measuring the total modulation characteristics of AM broadcast transmitters. Since the input circuitry is non-frequency discriminating, the AMM-3 is also suitable for measuring the modulation characteristics of shortwave transmitters as well as VHF transmitters. Two meters and two peak lights are provided to measure positive and negative modulation simultaneously. The negative modulation meter may be switched to read carrier level. Separate peak indicators are provided to indicate negative peaks in excess of 99% and positive peaks in excess of 125%. The AMM-3 incorporates a carrier-limit alarm and a modulation calibrator to insure the accuracy of the readings at any time.

1-2 PHYSICAL DESCRIPTION

The AMM-3 is constructed on a standard EIA 5¼ x 19-inch rack mount. Calibration adjustments are located within the unit and are accessible through the back cover. The AC power input, RF input, and monitor outputs are located at the rear of the AMM-3 chassis on individual connectors and a rear terminal block. The AMM-3 is completely solid state, utilizing silicon transistors and integrated circuits for long, trouble-free life. LEDs (light-emitting diodes) are used for the indicators to eliminate lamp burn-out.

The individual circuits are constructed on a military-grade, glass-epoxy, plated, printed circuit board. High-reliability military and industrial grade components are used throughout.

1-3 ELECTRICAL DESCRIPTION

The AMM-3 is a solid state, low-sensitivity, precision AM demodulator incorporating a highly linear, biased diode detector. The detector circuit will accurately demodulate AM envelopes of carriers from 200 kHz to 160 mHz. Various metering and testing provisions are contained within the monitor to measure transmitter output characteristics. These provisions include a peak-reading positive modulation meter; a peak-reading negative modulation meter that may be switched to read carrier level; a positive peak modulation light, adjustable from 1 to 199% peak modulation; a negative peak modulation light, adjustable from 1 to 99% peak modulation; a peak modulation light that responds when the negative modulation exceeds 99%; a peak modulation light that responds when the positive modulation exceeds 125%; a DC-type modulation

calibrator to check the ratio between the carrier level and peak modulation reading; a carrier alarm light that responds when the carrier is less than 90% of nominal value and greater than 105% of nominal value (this may be set to other values by the change of potentiometer settings)

Outputs obtained from the monitor include an output for aural monitoring, a distortion meter test output, a transistor driver for carrier alarm, and a transistor driver for remoting each of the four peak lights. FCC type-approved remote metering of the AMM-3 may be externally provided for the modulation meters.

The AMM-3 incorporates an analog divider to provide a true ratio measurement of the modulation envelope and the carrier level. The analog divider continuously references the demodulated output to the carrier so that the modulation readings are independent of carrier level. The carrier level is derived from the modulation cancellation scheme which makes the carrier level referenced independent of modulation symmetry.

1-4 ELECTRICAL SPECIFICATIONS

RF Frequency Range	200 kHz to 160 mHz
RF Sensitivity	5 to 10 Volts RMS
RF Input Impedance	1000 ohms std.(50 ohms opt. above 3 mHz)
Positive Modulation Meter Range	0 to 133% positive
Negative Modulation Meter Range	0 to 100% negative
Carrier Level Meter Range	0 to 133%
Modulation Meter Accuracies*	2% at 100% modulation
Positive Peak Modulation Indicator	1 to 199% in 1% increments (BCD encoded)
Negative Peak Modulation Indicator	1 to 99% in 1% increments (BCD encoded)
Peak Modulation Indicator Accuracies*	2%
100% Negative Indicator*	Adjustable 85 to 100%
125% Positive Indicator*	Adjustable 100 to 130%
Carrier Alarm	Fixed to alarm with a -10% and +5% change in carrier level.
Frequency Response	0.5 dB from 20-25,000 Hz
Pulse Response	Overshoot less than 1%
Distortion	0.25% max at 99% modulation
Signal to Noise Ratio	75 dB
Remote Metering	Meters may be remotely metered--5000 ohms external loop resistance
Aural Monitoring Output	+10 dBm, 600 ohms
Aural Proof-of-Performance Output	2.5 Volts RMS
Power Requirements	115/230 V, 50 to 400 Hz, at 15 Watts
Operating Temperature Range	0°C to +50°C

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* Over a ±30% input carrier level change.

1-5 MECHANICAL SPECIFICATIONS

Dimensions	5¼ x 19 x 8 inches overall (133 x 483 x 203mm)
Net Weight	10 pounds (4.5 kg)
Shipping Weight	14 pounds (6.4 kg)

1-6 INSTRUMENT IDENTIFICATION

The instrument is identified by the model number and a six-digit serial number. The model number and serial number appear on a plate located on the rear panel. All correspondence to your Belar representative or to the Belar factory in regard to the instrument should reference the model number and complete serial number.

1-7 ACCESSORIES

The Belar AMM-3 Modulation Monitor may be used for remote monitoring of an AM transmitter with either the Belar MP-7 Remote Meter and Flasher Panel or the Belar RFA-2 AM RF Amplifier. The MP-7 Remote Meter and Flasher Panel contains two modulation meters, four peak lights, and a carrier-alarm light. The AM RF amplifier provides preamplification and selectivity to permit direct off-air monitoring with the AMM-3.

SECTION 2

INSTALLATION

2-1 INITIAL INSPECTION

Check the shipping carton for external damage. If the carton exhibits evidence of abuse in handling (holes, broken corners, etc.), ask the carrier's agent to be present when the unit is unpacked. Carefully unpack the unit to avoid damaging the equipment through use of careless procedures. Inspect all equipment for physical damage immediately after unpacking. Bent or broken parts, dents and scratches should be noted. If damage is found, refer to Paragraph 2-2 for the recommended claim procedure. Keep all packing material for proof of damage claim or for possible future use.

2-2 CLAIMS

If the unit has been damaged, notify the carrier immediately. File a claim with the carrier or transportation company and advise Belar of such action to arrange the repair or replacement of the unit without waiting for a claim to be settled with the carrier.

2-3 REPACKING FOR SHIPMENT

If the unit is to be returned to Belar, enclose a letter with the unit showing owner, owner's street address and phone number. A description of the services required should be included in the letter. The original shipping carton and packaging materials should be used for reshipment. If they are not available or reuseable, the unit should be repackaged in the following manner:

a. Use a double-walled carton with a minimum test strength of 275 pounds.

b. Use heavy paper of sheets of cardboard to protect all surfaces.

c. Use a least 4 inches of tightly packed, industry approved, shock absorbing material such as extra firm polyurethane foam or rubberized hair. NEWSPAPER IS NOT SUFFICIENT FOR CUSHIONING MATERIAL.

d. Use heavy duty shipping tape to secure the outside of the carton.

e. Use large FRAGILE labels on each surface.

f. Return the unit, freight prepaid. Be sure to insure the unit for full value.

2-4 PREPARATION FOR USE

The AMM-3 AM Modulation Monitor is designed to be mounted in a standard 19 inch rack mount. When mounted in a rack, a slight air space should be provided above and below the unit. When the monitor is mounted above high-heat generating equipment such as vacuum-tube equipment or power supplies, consideration should be given to cooling requirements which allow a free movement of cooler air around the AMM-3. In no instance should the ambient chassis temperature be allowed to rise above 50°C (122°F). Mount the AMM-3 to the rack mount using four No. 10 screws and non-marring washers.

The Model AMM-3 requires a 115/230 VAC, single-phase, 50-400 Hz power source. The monitor can be easily converted from 115 to 230 volt operation by changing the position of the slide switch located on the rear panel so that the designation appearing on the switch matches the nominal voltage of the power source. Note that this should be done with the unit disconnected from the power source.

The Model AMM-3 is supplied with a three-conductor power cable which, when plugged into an appropriate receptacle, grounds the unit. The offset pin of the power cable three-prong connector is the ground wire. To preserve the grounding feature when operating the unit from a two-contact outlet, use a three-prong to two-prong adaptor and connect the green pigtail on the adaptor to ground. Attach the power cable between the unit and the power source receptacle.

CAUTION: BEFORE APPLYING ANY RF INPUT, TURN CARRIER LEVEL CONTROL MAXIMUM COUNTERCLOCKWISE.

Connect a coaxial cable between the monitoring probe on the transmitter (or RF Amplifier) and the RF INPUT connector J2, at the rear of the main chassis.

CAUTION: DO NOT APPLY MORE THAN 15 VOLTS RF TO THE MONITOR OR THE RF INPUT CIRCUIT MAY BE DAMAGED.

If desired, connect the external aural monitoring amplifier to terminals 11 and 12 on TB-1. Note that this is an unbalanced 600 ohm output with terminal 12 grounded. A remote carrier level meter may be connected to terminals 8 and 12 with 10K ohms loop resistance. Remote modulation meters may be connected to terminals 9 and 12 for positive and 10 and 12 for negative modulation. Observe the proper polarities (terminals 8,9 and 10 are positive terminals), and note that the external loop resistance requirements must be met. If only one remote meter is used, the other modulation metering circuit must be terminated on TB-1 in order for the internal meters to read correctly when the remote meter switch is depressed. For example, if only the positive remote modulation meter is used and the remote meter switch is depressed, the positive modulation meter will read correctly but the negative modulation meter will read approximately 6% low unless a 7.5K resistor is placed between terminals 10 and 12 on TB-1. Remote modulation meters should be obtained from Belar in order to conform with the correct ballistic requirements. A remote positive peak modulation

light may be connected to terminals 1 and 3 on TB-1. A remote negative peak modulation light may be connected to terminals 1 and 4 on TB-1. Remote 100% negative, 125% positive, and carrier alarm lights may be connected to the appropriate terminals on TB-1. Note that terminal 1 is a 5-volt DC source, and if light-emitting diodes (LEDs) are used for the lights, series resistors must be used to limit the current to safe values for the LEDs used. The remote meters and lights are contained in the MP-7 Remote Meter and Flasher Panel.

SECTION 3

OPERATION

3-1 INITIAL OPERATION

The following procedure should be followed for placing the unit into initial operation.

1. Before turning the unit on, be sure the position of the 115/230 VAC switch on the back apron coincides with the voltage source used.

2. Depress the ZERO switch, NEG mod switch and release the REMOTE switch. Turn CARRIER SET control on the back apron maximum counterclockwise.

3. Depress the POWER switch. Note that the MODULATION meters indicate approximately zero. Allow a few minutes warm-up.

4. After warm-up, the MODULATION meters should read zero. If they do not read zero but are only off a few percentage points, they may be set to read zero with the mechanical zero controls on the meters. If the zero is off more than a few percentage points, the zero should be set according to step 8 of the modulation processor alignment procedure in the maintenance section. The electrical zeros are stabilized by feed-back operational amplifiers and normally do not need readjustments.

5. Depress CARRIER switch. Rotate the CARRIER SET control clockwise. The CARRIER ALARM light will go out at approximately 90% carrier. Continue to rotate the control so that the CARRIER level meter reads 100%. Note that this is the carrier level set point for measuring carrier shift and carrier level. Note that the modulation readings are independent of carrier level.

6. Depress the CAL switch. The MODULATION meters will read 100% to verify the accuracy of the calibration. The +125% light will be on. The -100% light will be on.

7. Adjust the POSITIVE digital switch to the point where the POSITIVE peak modulation light just turns on. This setting will be 100%. Note that the NEGATIVE peak modulation light is on. The 100% point is not on the NEGATIVE digital switch but is switched in with the CAL switch.

8. Depress OPER switch and the monitor is ready for operation with the right meter reading positive modulation. Note that the left meter reads negative modulation when the NEG switch is depressed and carrier level when the CARRIER switch is depressed.

3-2 NORMAL OPERATION

For normal operation, leave the AMM-3 in OPER and NEG switch positions when broadcasting super-modulation. The MODULATION meters will read positive and negative modulations simultaneously. Nominal changes (±30%) in RF level will not affect the accuracy of either the MODULATION meters or the peak lights; however, the CARRIER ALARM will turn on at deviations greater than -10% or +5%.

The POSITIVE digital switch is usually set to a level slightly lower than +125%, say +120%. The NEGATIVE digital switch is usually set to a level slightly lower than 99%, say 95%. Then the modulation may be set for frequently recurring peaks of -95%. Note that the correct type of audio processing limiter must be used for this type of operation. The separate -100% and +125% lights are used to insure the maximum level of modulation without exceeding the limits set by the FCC.

When the CARRIER switch is depressed, percent carrier shift is read on the left MODULATION meter as a change in carrier intensity during modulation. Note that due to the unique modulation cancellation scheme in the AMM-3 to regenerate unmodulated carrier, this change in carrier intensity is independent of modulation symmetry. In this manner, accurate carrier shifts are measured.

3-3 TRANSMITTER MEASUREMENTS

Normal transmitter proof-of-performance measurements may be made with the AMM-3. Frequency response, distortion, and noise measurements may be made through the rear panel AUDIO TEST jack J3. 2.5 volts RMS is available at 100% modulation so that most distortion and noise analyzers may be used. The bandwidth at this test jack is limited to 25 kHz by an additional low-pass filter. If the full 50 kHz bandwidth is needed, the aural output from terminals 11 and 12 on TB-1 may be used. The output level from these terminals is 5 volts RMS unterminated. Percent modulation is read on the MODULATION meters and percent carrier shift is read on the left MODULATION meter when the CARRIER level switch is depressed.

Note that positive peaks of up to 199% may be measured with the POSITIVE peak modulation light since the overload point of the associated circuitry is greater than 200%. Also note that it is impossible to modulate more than 100% negative since by definition 100% negative modulation is carrier shut-off. Conventional monitors may read more than 100% negative modulation because overshoots may be generated in their filters at carrier shut-off and these monitors read the overshoot. The Belar AMM-3 employs a phase linear filter that produces no overshoot so that carrier shut-off produces 100% negative modulation.

AM noise on an unmodulated carrier may be measured by depressing the NOISE switch. This switches in a 40 dB amplifier on the righthand meter. A 0 dB meter reading corresponds to a 40 dB signal-to-noise ratio; a -20 dB meter reading corresponds to a 60 dB signal-to-noise ratio, etc.

SECTION 4

MAINTENANCE

4-1 TEST EQUIPMENT REQUIRED

VTVM
High frequency oscilloscope with 5" display.
Linear modulator, output level of 5-10 volts RMS, unmodulated*
Low distortion oscillator

*Note: The modulation meter and peak lights respond to peak values of modulation so that if there is distortion in the modulator, the peak indications will be the true peak values, i.e., the sum of the fundamental and the harmonics or distortion products. The most common mistake made in calibrating AM monitors is to adjust the modulation level until carrier shut-off is reached. This is defined as 100% negative and, indeed, it is 100% negative, but the positive value is not necessarily 100%. If the distortion is 3% at this level (typical of many transmitters), the positive value of modulation may be anywhere from 97% to 103%, depending on the phase of the harmonics, and the monitor will read this. For this reason, the monitor should be calibrated at just 100% negative on the negative indications and then the modulation backed off to 90% for the positive indications so they can be set in the region where the transmitter is more linear.

4-2 POWER SUPPLY ALIGNMENT

1. Set mechanical zero on both meters.

2. Turn power on and allow to warm up for 15 minutes.

3. With VTVM, measure voltage at U1 Pin 7. Voltage should be +15.5 volts ±0.5 volts. Adjust R88 for correct reading.

4. With VTVM, measure voltage at U1 Pin 4. Voltage should be -15.5 volts ±0.5 volts. Adjust R82 for correct reading.

4-3 MODULATION PROCESSOR ALIGNMENT

1. Apply an unmodulated RF level of 5-10 volts RMS to input, J2, of monitor.

2. Place function switch in CAR position and adjust Carrier Set potentiometer (R1) on rear chassis for 100% on the left-hand meter.

3. Place function switch in ZERO position.

4. Disconnect Carrier Reference (yellow/white) wire from Pin 13. Connect a jumper wire from the positive terminal of filter capacitor C5 on chassis to Pin 13 on the board. Connect oscilloscope at the junction of R44 and Q4. Adjust vertical amplifier for maximum sensitivity. If R38 is in need of adjustment, a 120 Hz ripple will appear on the oscilloscope. Adjust R38 to balance the 120 Hz ripple to zero. Reconnect Carrier Reference wire to Pin 13.

5. Place function switch in ZERO mode and the probe of the VTVM at the junction of R44 and Q4. The VTVM should measure zero volts. Adjust R32 for correct reading.

6. Place function switch in the OPER. mode, and apply a 1 kHz tone to the modulator and adjust the level for a modulation reading of 80-90%, as observed on the oscilloscope.

7. Slowly adjust Carrier Set Potentiometer (R1) on rear chassis so that the carrier level is varied from 50% to 133%. Place left-hand meter in NEG position. The modulation meters should remain within 2% as the carrier input level is adjusted. If they do not, then R30 should be adjusted for minimum meter variation as the carrier level is adjusted. (If the positive meter shows a 10% positive variation when the carrier level is changed from 133% to 50%, then the meter reading should be reduced by 15% when the carrier level is set to 50% by adjusting R30).

8. Re-check step 5, then place the function switches in ZERO and NEG position. The negative meter should read zero. Adjust R55 for correct reading. The positive meter should also read zero. Adjust R56 for correct reading. Set Carrier Level to 100%.

9. Apply a 1 kHz tone to the modulator and adjust level for 100% negative modulation as observed on the oscilloscope. Depress OPER on function switch. Negative meter should indicate 100%. If not, adjust R25 for correct reading (SEE NOTE) repeat steps 5,8 and 9 to achieve optimum operation.

10. Depress CAL switch. Negative meter should indicate 100%. Adjust R120 for correct indication. The positive meter should indicate 100%. Adjust R50 for correct reading.

4-4 PEAK INDICATOR ALIGNMENT

+125% Peak Indicator:

With CAL switch depressed, the 125% peak indicator should be on. If not, adjust R130 for correct indication.

Positive Peak Indicator:

With CAL switch depressed and thumbwheel switch adjusted for 100 the Positive Indicator should be on. Advance the thumbwheel switch for a reading of 101. The Positive Peak Indicator should be off. If not, adjust R104 so that the peak indicator turns on at 100 and off at 101.

-100% Peak Indicator:

Depress CAL switch. -100% peak indicator should be on. If not, adjust R132 for correct indication.

Negative Peak Indicator:

Depress CAL switch. Negative peak indicator should be on. If not, adjust R128 for correct indication.

Carrier Limit Alarm Indicator:

Depress CAR switch. Adjust carrier input level for 100% on meter. Carrier alarm indicator should be off.

a. Lower Limit Adjustment: Set carrier level for 90% on meter. Carrier alarm indicator should be on. If not, adjust R18 for correct operation.

b. Upper Limit Adjustment: Set carrier level for 105% on meter. Carrier alarm indicator should be on. If not, adjust R65 for correct operation.

4-5 NOISE MEASUREMENT CALIBRATION:

Depress OPER switch. Adjust the modulation level for a reading of 100% on positive meter, and a modulating frequency of 400 Hz. Reduce the modulation level 40 dB. Depress Noise Switch, positive meter should indicate 100%. If not, adjust R75 for correct reading.

REPLACEABLE PARTS

INTRODUCTION

This section contains information for ordering replaceable parts for the monitor. The table lists the parts in alphanumerical order of their reference designations and provides a description of the part with the manufacturer's part number.

ORDERING INFORMATION

To order a replacement part from Belar, address the order or inquiry to Belar and supply the following information:

a. Model number and serial number of the unit.

b. Description of part including the reference designation and location.

To order a part from a manufacturer other than Belar, provide a complete part description and the manufacturer's part number from the table.

REFERENCE DESIGNATORS

A	assembly	J	jack	S	switch
C	capacitor	L	inductor	T	transformer
DS	device signaling (lamp)	M	meter	TB	terminal board
F	fuse	P	plug	W	cable
FL	filter	Q	transistor	X	socket
		R	resistor	Y	crystal

ABBREVIATIONS

CER	ceramic	PC	printed circuit
COMP	composition	PF	picofarads
CONN	connector	PIV	peak inverse voltage
ELECT	electrolytic	POLY	polystyrene
F	farads	PORC	porcelain
FLM	film	POT	potentiometer
FXD	fixed	SEMICON	semiconductor
GE	germanium	SI	silicon
K	kilo = 1000	U	micro
M	meg = 1,000,000	VDCW	DC working volts
METFLM	metal film	W	watts
MY	mylar	WW	wire wound

AMM-3V LINE VOLTAGE SELECTION PROCEDURE

Units prior to serial number 142386V:

1. Unplug line cord.
2. Place S1 in the 115V or 230V position.
3. Check that fuse F1 is the proper current rating for the line voltage in use (1/2A 250V for 115Vac, 1/4A 250V for 230Vac).
4. Plug line cord in.

Units beginning serial number 142386V:

1. Unplug line cord.
2. Open fuse compartment door.
3. Move fuse pull lever to left to remove fuse. Leave fuse pull lever in the leftmost position.
4. Using needle nose pliers, pull the voltage select board straight out of the power entry module.
5. While facing the rear of the unit, orient the voltage select board so the desired line voltage is up and reads correctly ("120" for 115Vac operation, "240" for 230Vac operation).
   Note: The "100" and "220" positions on the opposite side of the board are not used.
6. Plug the voltage select board into the power entry module.
7. Install the proper fuse (F1) for the line voltage in use (1/2A 250V for 115Vac, 1/4A 250V for 230Vac).
8. Close fuse compartment door.
9. Plug line cord in.

The AMM-3V power supply has been modified due to the unavailability of the MC1468L I.C. on the A1 board (U13).

BEGINNING WITH SERIAL NUMBER 142753; THE FOLLOWING MANUAL CHANGES APPLY:

1. Disregard the power supply alignment procedure in the maintenace section of the manual.

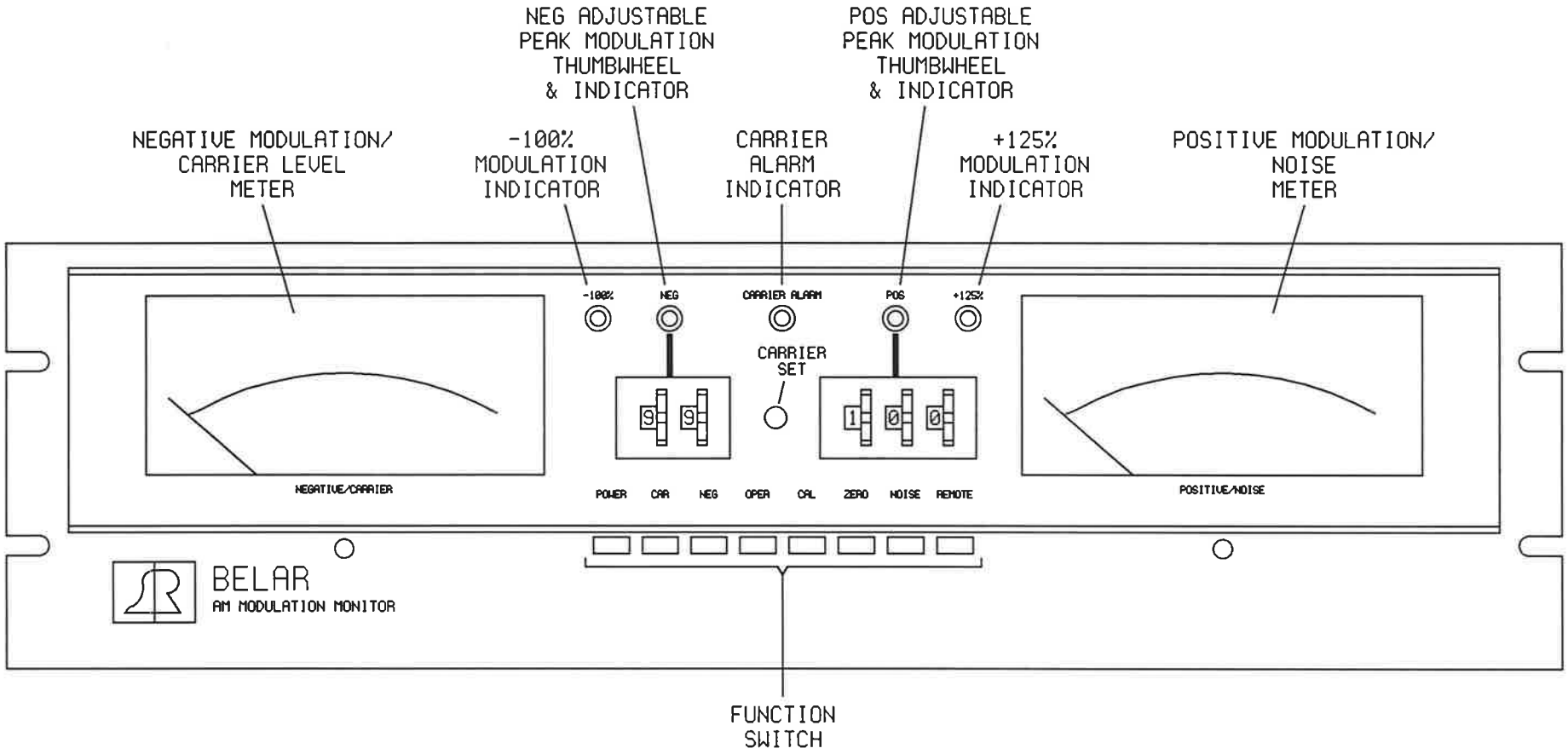
2. The following parts are added to the chassis parts list:

C18,C19	C: FIXED CERAMIC 0.1uF 50V	0151-0006
U2	IC: 7915C	1826-0033
U3	IC: 7815C	1826-0031

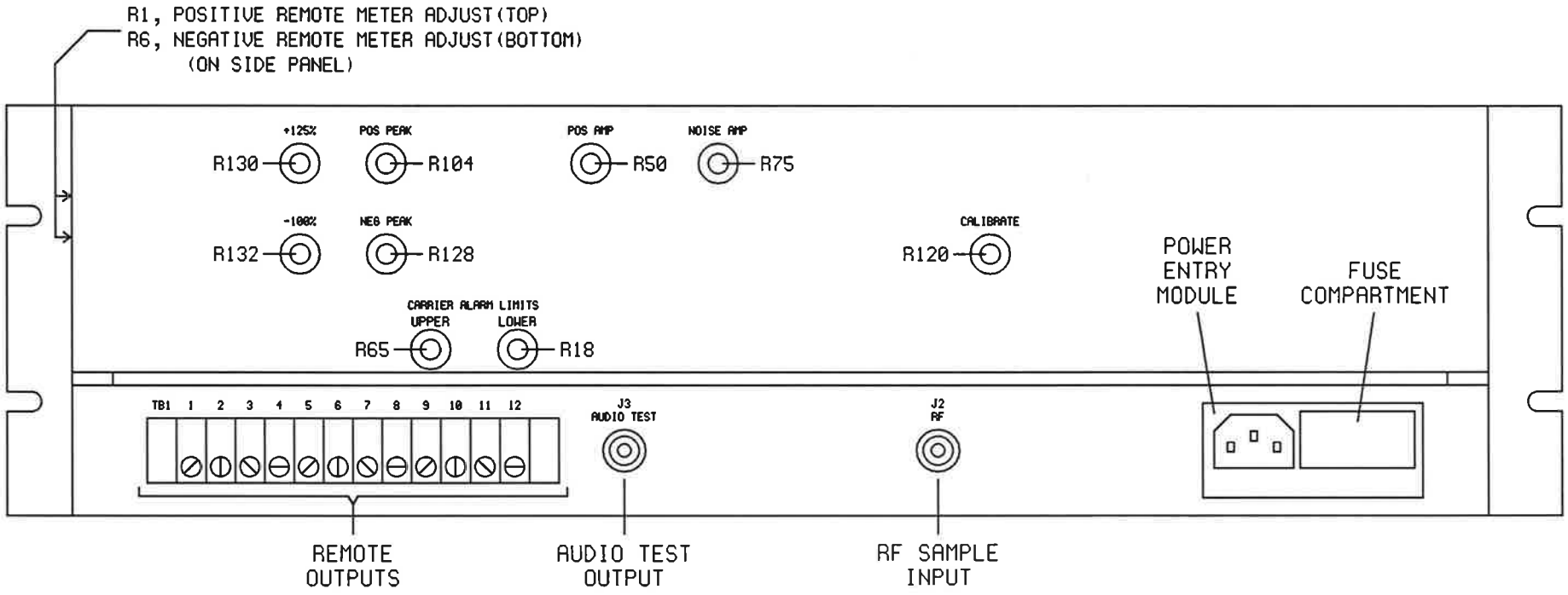
3. The following parts are deleted from the A1 board parts list and part location table:

C22,C23	C: FIXED CERAMIC 0.0015uF 1kV	0151-0009
C25,C26	C: FIXED CERAMIC 0.1uF 50V	0151-0006
Q6	TRANSISTOR: 2N3053	1850-0008
Q7	TRANSISTOR: 2N4037	1850-0011
R82 & R88	R: VAR COMP 100k	2100-0019
R83 & R87	R: FIXED COMP 10k 5% 1/4W	0683-1035
R84,R85	R: FIXED COMP 4.7 5% 1/2W	0686-47G5
R86 & R89	R: FIXED COMP 51 5% 1/4W	0683-5105
U13	IC: MC1468L	1826-0002

A standard AMM-3 monitor chassis wiring schematic, A1 board schematic and A1 board component layout drawing have been included in this manual for reference. These drawings show the new power supply configuration.



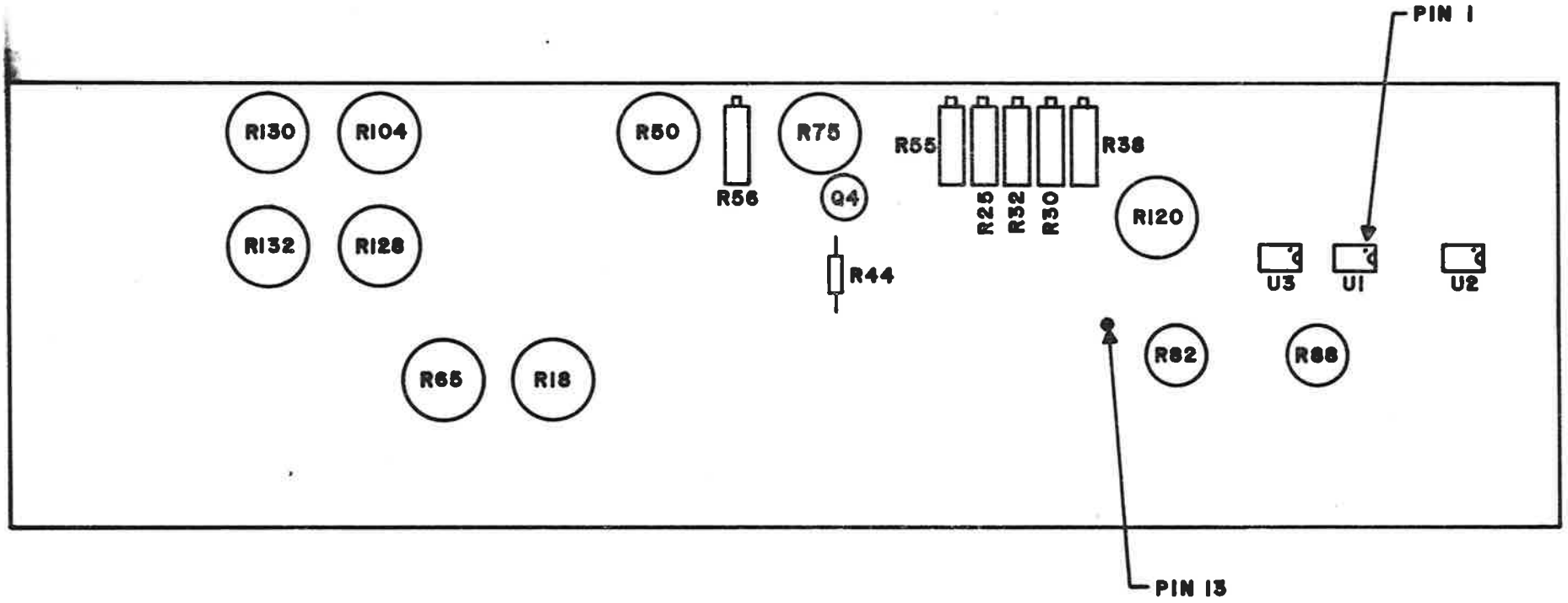
AMM-3V FRONT PANEL
CONTROLS & INDICATORS
BELAR ELECTRONICS



TB1 CONNECTIONS:

1. +5V DC
2. CARRIER LIMIT ALARM > N.O. CONTACTS
3. CARRIER LIMIT ALARM
4. ADJ. NEGATIVE MODULATION PEAK INDICATOR
5. ADJ. POSITIVE MODULATION PEAK INDICATOR
6. -100% MODULATION INDICATOR
7. +125% MODULATION INDICATOR
8. AURAL MONITOR SIGNAL (BAL 600 OHM)
9. AURAL MONITOR SIGNAL (BAL 600 OHM)
10. POSITIVE MODULATION REMOTE METER
11. NEGATIVE MODULATION REMOTE METER
12. GROUND

AMM-3V REAR PANEL
CONNECTIONS & ADJUSTMENTS
BELAR ELECTRONICS



AMM-3 CALIBRATION CONTROL COMPONENTS

SECTION 5
AMM-3V PARTS LISTS

MAIN CHASSIS

Reference Designation	Description		Part Number
A1	ASSEMBLY: PRINTED CIRCUIT BOARD		Belar
A2	ASSEMBLY: RESISTOR BOARD FOR S3		Belar
A3	ASSEMBLY: RESISTOR BOARD FOR S4		Belar
A4	ASSEMBLY: PRINTED CIRCUIT BOARD		Belar
C1,C2	C: FIXED CERAMIC 0.01uF 1.4kV	(NOTE 2)	0151-0010
C3 thru C5	C: FIXED ELECT 3500uF 40V	(NOTE 1)	0180-0026
C6 thru C16	C: FIXED CERAMIC 0.001uF 1kV		0151-0002
C17	C: FIXED CERAMIC 0.1uF 50V	(NOTE 1)	0151-0006
CR1	LED: YELLOW MV5353		1910-0002
CR2 thru CR4	LED: RED MV5053		1910-0001
CR5	LED: GREEN MV5253		1910-0003
DS1,DS2	LAMP: 1847		2140-0005
--	SOCKET: LAMP		1450-0012
F1	FUSE: AGC 1/2A 250V (120 Vac line voltage)		2110-0001
	AGC 1/4A 250V (240 Vac Line voltage)		2110-0002
--	FUSEHOLDER:	(NOTE 2)	2110-0003
J1	JACK: POWER	(NOTE 2)	0360-0010
J2,J3	JACK: BNC		0360-0005
M1,M2	METER: MOD 0-133%		1120-0012
R1	R: VAR COMP 1k 2W		2100-0017
R2	R: FIXED CARBON 7.5k 5% 1/4W		0683-7525
S1	SWITCH: SLIDE 115/230V SELECTOR	(NOTE 2)	3102-0002
S2	SWITCH: PUSHBUTTON (8 button)		3101-0014
S3	SWITCH: THUMBWHEEL (3 Section)		3103-0002A
S4	SWITCH: THUMBWHEEL (2 Section)		3103-0003A
T1	TRANSFORMER: POWER		9100-0010
TB1	TERMINAL BLOCK: 12 SCREW		0360-0002
U1	IC: 7805CT		1826-0014
--	LINE CORD		8120-0002

NOTE 1: Prior to serial number 142316V - C3 thru C5 were 1000uF 50v (0180-0002) and C17 was not used.

NOTE 2: Beginning serial number 142386V these parts are replaced by the 6J4 power entry module (0360-0020).

AMM-3V - A1 BOARD

Reference Designation	Description	Part Number
C1,C2	C: FXD MICA 1500pF 5% 500V	0141-1525
C3	C: FXD CER 0.01uF 100V	0151-0003
C4	C: FXD CER 0.1uF 50V	0151-0006
C5	C: FXD MICA 270pF 5% 500V	0140-2715
C6	C: FXD MICA 160pF 5% 500V	0140-1615
C7	C: FXD MICA 27pF 5% 500V	0140-2705
C8,C9	C: FXD ELECT 47MFD 63VDC	0180-0017
C10,C11	C: FXD FLM 0.22uF 10% 80V	0120-2241
C12,C13	C: FXD CER 0.01uF 100V	0151-0003
C14	C: FXD TANT 4.7uF 10V	0185-0001
C15	C: FXD CER 0.01uF 100V	0151-0003
C16	C: FXD ELECT 47MFD 63VDC	0180-0017
C17	C: FXD MICA 750pF 5% 300V	0140-7515
C18,C19	C: FXD POLY 1000pF 2.5% 160V	0130-1022
C20	C: FXD MICA 750pF 5% 300V	0140-7515
C21	C: FXD TANT 6.8uF 25V	0185-0002
C22,C23	C: FXD CER 0.001uF 1kV	0151-0002
C24	C: FXD TANT 6.8uF 25V	0185-0002
C25,C26	C: FXD CER 0.1uF 50V	0151-0006
C27 thru C31	C: FXD TANT 15uF 15V	0185-0003
C32	C: FXD CER 0.01uF 100V	0151-0003
C33	C: FXD MICA 500pF 5% 500V	0140-5015
C34	C: FXD MICA 20pF 5% 500V	0140-2005
C35	C: FXD ELEC 47MFD 63VDC	0180-0017
CR1	DIODE: 1N4006	1900-0016
CR2	DIODE: 1N643	1900-0017
CR3,CR4	DIODE: 1N4446	1900-0002
CR5 thru CR9	DIODE: AA119	1900-0001
CR10	DIODE: 1N4446	1900-0002
CR11	DIODE: AA119	1900-0001
CR12	DIODE: 1N4446	1900-0002
CR13,CR14	DIODE: AA119	1900-0001
CR15	DIODE: 1N4446	1900-0002
CR16	DIODE: AA119	1900-0001
CR17	DIODE: 1N4446	1900-0002
CR18 thru CR25	DIODE: 1N4006	1900-0016
CR26	DIODE: 1N4446	1900-0002
L1 thru L6	INDUCTOR: FXD	Belar
Q1	TRANSISTOR: 2N4037	1850-0011
Q2,Q3	TRANSISTOR: 2N914	1850-0006
Q4,Q5,Q6	TRANSISTOR: 2N3053	1850-0008
Q7	TRANSISTOR: 2N4037	1850-0011
Q8	TRANSISTOR: 2N914	1850-0006
Q9	TRANSISTOR: 2N3053	1850-0008
Q10	TRANSISTOR: 2N4037	1850-0011
Q11,Q12,Q13	TRANSISTOR: 2N914	1850-0006
Q14	TRANSISTOR: 2N4037	1850-0011

AMM-3V - A1 BOARD

Reference Designation	Description	Part Number
R1	R: FXD COMP 20k 5% ¼W	0683-2035
R2	R: FXD COMP 75k 5% ¼W	0683-7535
R3	R: FXD FLM 6.19k 1% 1/8W	0721-6191
R4	R: FXD FLM 3.92k 1% 1/8W	0721-3921
R5	R: FXD COMP 4.7k 5% ¼W	0683-4725
R6	R: FXD FLM 20k 1% 1/8W	0721-2002
R7 thru R12	R: FXD FLM 10k 1% 1/8W	0721-1002
R13	R: FXD FLM 12.1k 1% 1/8W	0721-1212
R14	R: FXD COMP 15k 5% ¼W	0683-1535
R15	R: FXD FLM 3.92k 1% 1/8W	0721-3921
R16	R: FXD COMP 3k 5% ¼W	0683-3025
R17	R: FXD FLM 8.25k 1% 1/8W	0721-8251
R18	R: VAR WW 1k 2W	2100-0012
R19	R: FXD FLM 2.21k 1% 1/8W	0721-2211
R20,R21	R: FXD COMP 15k 5% ¼W	0683-1535
R22	R: FXD (DETERMINED BY MANUFACTURER)	
R23	R: FXD COMP 2.2k 5% ¼W	0683-2225
R24	R: FXD FLM 13k 1% 1/8W	0721-1302
R25	R: VAR CER 10k, 10 TURN	2100-0018
R26	R: FXD FLM 12.1k 1% 1/8W	0721-1212
R27	R: FXD FLM 3.92k 1% 1/8W	0721-3921
R28	R: FXD FLM 4.99k 1% 1/8W	0721-4991
R29	R: FXD FLM 10k 1% 1/8W	0721-1002
R30	R: VAR CER 10k, 10 TURN	2100-0018
R31	R: FXD FLM 2k 1% 1/8W	0721-2001
R32	R: VAR CER 10k, 10 TURN	2100-0018
R33,R34	R: FXD FLM 10k 1% 1/8W	0721-1002
R35	R: FXD FLM 2k 1% 1/8W	0721-2001
R36	R: FXD FLM 3.01k 1% 1/8W	0721-3011
R37	R: FXD FLM 18.2k 1% 1/8W	0721-1822
R38	R: VAR CER 10k, 10 TURN	2100-0018
R39	R: FXD FLM 3.01k 1% 1/8W	0721-3011
R40	R: FXD FLM 18.2k 1% 1/8W	0721-1822
R41	NOT USED	
R42,R43	R: FXD FLM 10k 1% 1/8W	0721-1002
R44	R: FXD COMP 750 5% ½W	0686-7515
R45 thru R48	R: FXD FLM 10k 1% 1/8W	0721-1002
R49	R: FXD FLM 9.09k 1% 1/8W	0721-9091
R50	R: VAR WW 3k 2W	2100-0005
R51	R: FXD COMP 1k 5% ½W	0686-1025
R52,R53	R: FXD COMP 8.2M 5% ¼W	0683-8255
R54	R: FXD COMP 1k 5% ¼W	0683-1025
R55,R56	R: VAR CER 10k, 10 TURN	2100-0018
R57	R: FXD COMP 2.2k 5% ¼W	0683-2225
R58	R: FXD (DETERMINED BY MANUFACTURER)	
R59,R60	R: FXD FLM 1k 1% 1/8W	0721-1001
R61	R: FXD (DETERMINED BY MANUFACTURER)	
R62,R63	R: FXD FLM 1k 1% 1/8W	0721-1001

AMM-3V - A1 BOARD

Reference Designation	Description	Part Number
R64	R: FXD FLM 3.92k 1% 1/8W	0721-3921
R65	R: VAR WW 1k 2W	2100-0012
R66	R: FXD FLM 3.01k 1% 1/8W	0721-3011
R67	R: FXD COMP 15k 5% ¼W	0683-1535
R68,R69	R: FXD COMP 1.5k 5% ¼W	0683-1525
R70,R71	R: FXD COMP 10k 5% ¼W	0683-1035
R72	R: FXD COMP 1k 5% ¼W	0683-1025
R73	R: FXD COMP 10k 5% ¼W	0683-1035
R74	R: FXD COMP 8.2k 5% ¼W	0683-8225
R75	R: VAR WW 100 2W	2100-0013
R76	R: FXD COMP 10k 5% ¼W	0683-1035
R77	R: FXD COMP 39k 5% ¼W	0683-3935
R78	R: FXD COMP 10k 5% ¼W	0683-1035
R79	R: FXD COMP 620 5% ¼W	0683-6215
R80,R81	R: FXD COMP 10k 5% ¼W	0683-1035
R82	R: VAR COMP 100k 20% ¼W	2100-0019
R83	R: FXD COMP 10k 5% ¼W	0683-1035
R84,R85	R: FXD COMP 4.7 5% ½W	0686-4725
R86	R: FXD COMP 51 5% ¼W	0683-5105
R87	R: FXD COMP 10k 5% ¼W	0683-1035
R88	R: VAR COMP 100k 20% ¼W	2100-0019
R89	R: FXD COMP 51 5% ¼W	0683-5105
R90	R: FXD (DETERMINED BY MANUFACTURER)	
R91	R: FXD FLM 499 1% 1/8W	0721-4990
R92	R: VAR (DETERMINED BY MANUFACTURER)	
R93,R94,R95	R: FXD FLM 4.99k 1% 1/8W	0721-4991
R96	R: VAR (DETERMINED BY MANUFACTURER)	
R97	R: FXD FLM 499 1% 1/8W	0721-4990
R98	R: VAR (DETERMINED BY MANUFACTURER)	
R99,R100,R101	R: FXD FLM 4.99 1% 1/8W	0721-4991
R102	R: VAR (DETERMINED BY MANUFACTURER)	
R103	R: FXD FLM 15k 1% 1/8W	0721-1502
R104	R: VAR WW 3k 2W	2100-0005
R105	R: FXD FLM 10k 1% 1/8W	0721-1002
R106	R: FXD COMP 15k 5% ¼W	0683-1535
R107	R: FXD COMP 1k 5% ¼W	0683-1025
R108	R: FXD COMP 30k 5% ¼W	0683-3035
R109	R: FXD COMP 2.2k 5% ¼W	0683-2225
R110	R: FXD (DETERMINED BY MANUFACTURER)	
R111	R: FXD FLM 5.11k 1% 1/8W	0721-5111
R112	R: FXD COMP 4.3k 5% ¼W	0683-4325
R113	R: FXD FLM 5.11k 1% 1/8W	0721-5111
R114	R: FXD COMP 4.3k 5% ¼W	0683-4325
R115,R116	R: FXD FLM 5.11k 1% 1/8W	0721-5111
R117	R: FXD (DETERMINED BY MANUFACTURER)	
R118	R: FXD COMP 1k 5% ¼W	0683-2225
R119	R: FXD FLM 5.11k 1% 1/8W	0721-5111
R120	R: VAR WW 3k 2W	2100-0005

AMM-3V - A1 BOARD

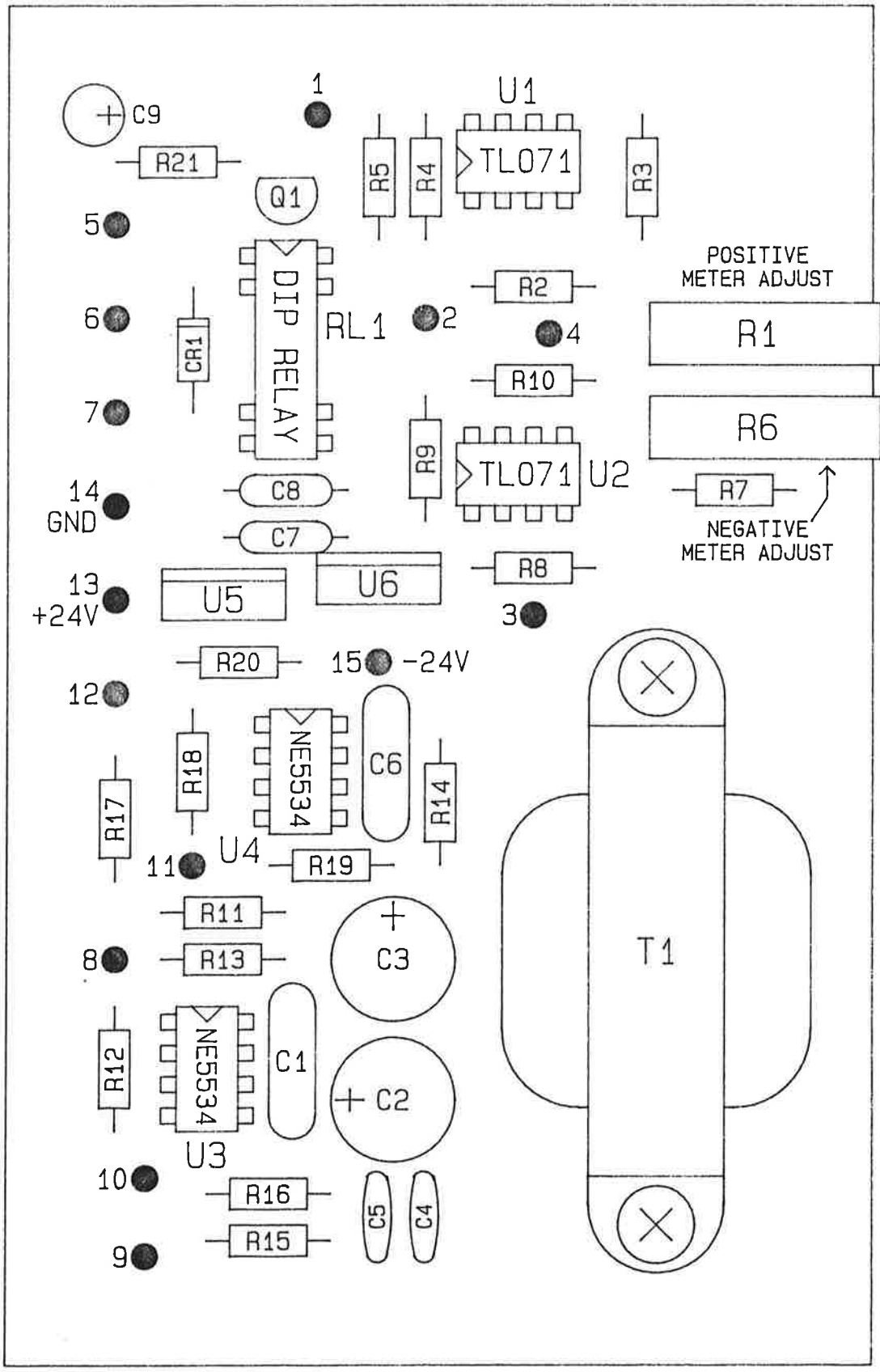
Reference Designation	Description	Part Number
R121	R: FXD COMP 7.5k 5% ¼W	0683-7525
R122	R: FXD FLM 2.49k 1% 1/8W	0721-2491
R123	R: FXD FLM 10k 1% 1/8W	0721-1002
R124	R: FXD FLM 2.49k 1% 1/8W	0721-2491
R125	R: FXD FLM 1k 1% ½W	0721-1001
R126,R127	R: FXD FLM 15k 1% 1/8W	0721-1502
R128	R: VAR WW 3k 2W	2100-0005
R129	R: FXD FLM 10k 1% 1/8W	0721-1002
R130	R: VAR WW 3k 2W	2100-0005
R131	R: FXD FLM 499 1% 1/8W	0721-4990
R132	R: VAR WW 300 2W	2100-0004
R133	R: FXD FLM 1k 1% ½W	0721-1001
R134	R: FXD FLM 10k 1% 1/8W	0721-1002
R135,R136,R137	R: FXD COMP 15k 5% ¼W	0683-1535
R138,R139,R140	R: FXD COMP 30k 5% ¼W	0683-3035
R141,R142,R143	R: FXD COMP 2.2k 5% ¼W	0683-2225
R144,R145,R146	R: FXD (DETERMINED BY MANUFACTURER)	
R148	R: FXD COMP 7.5k 5% ¼W	0683-7525
R149	R: FXD FLM 15k 1% 1/8W	0721-1502
R150	R: FXD FLM 3.01k 1% 1/8W	0721-3011
R151	R: FXD (DETERMINED BY MANUFACTURER)	
R152	R: FXD COMP 1.5k 5% ¼W	0683-1525
R153,R154	R: FXD FLM 4.99k 1% 1/8W	0721-4991
R155	R: FXD COMP 1k 5% ¼W	0683-1025
U1,U2,U3	IC: MC1741CP1	1826-0006
U4	IC: MC3302P	1826-0005
U5	IC: MC1495L	1826-0007
U6	IC: MC1709G	1826-0008
U7	IC: MC1741SCP1	1826-0004
U8,U9	IC: CA3140S	1826-0001
U10	IC: MC1741SCP1	1826-0004
U11	IC: SN7400N	1821-0001
U12	IC: MC1741SCP1	1826-0004
U13	IC: MC1468L	1826-0002
U14 thru U17	IC: MC1741CP1	1826-0006
U18	IC: MC3302P	1826-0005
U19	IC: SN74122N	1821-0015
U20	IC: MC1741CP1	1826-0006
U21,U22,U23	IC: SN74122N	1821-0015

AMM-3V - A2 & A3 BOARDS

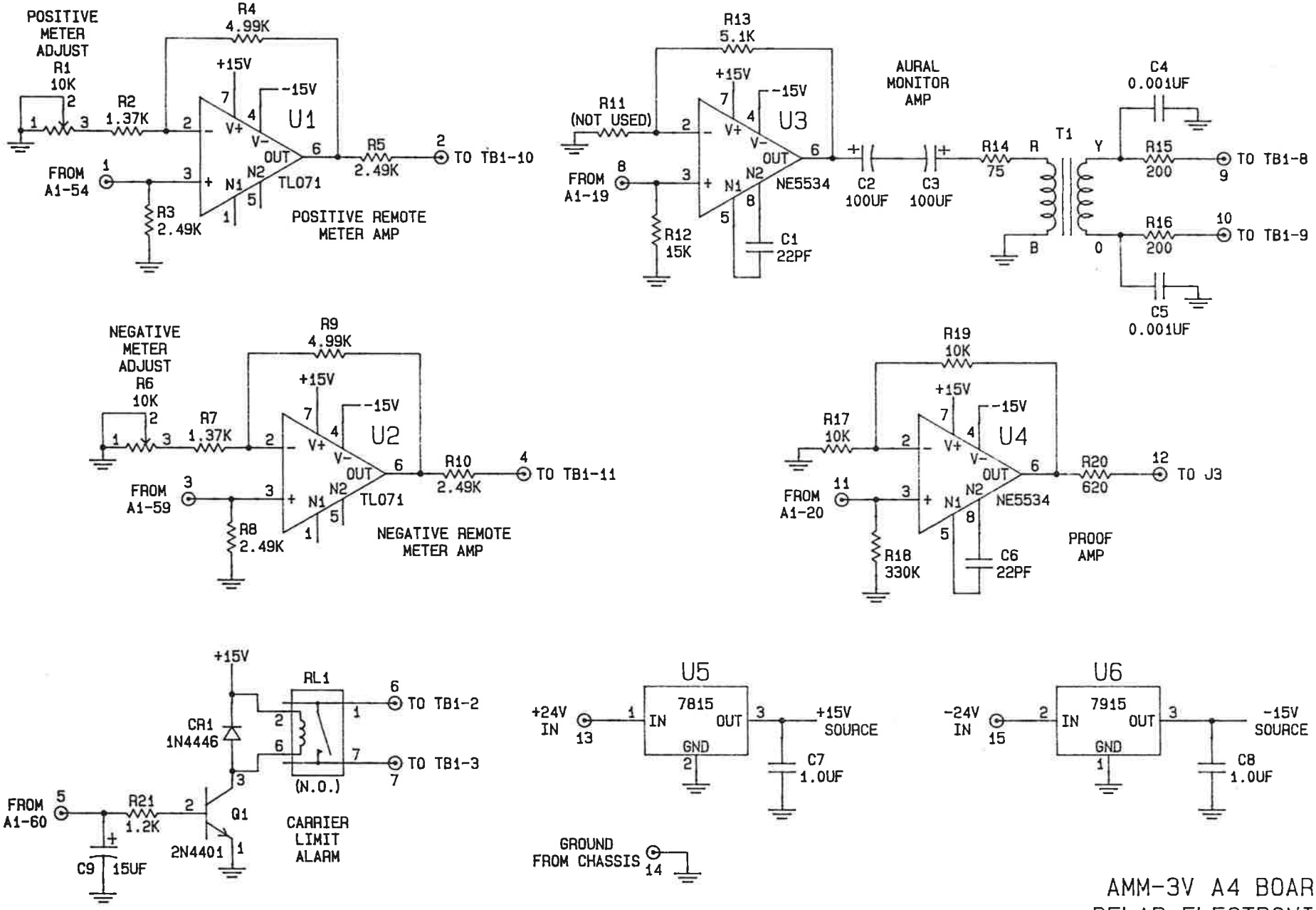
Reference Designation	Description	Part Number
R1	R: FXD FLM 100k 1% 1/8W	0721-1003
R2	R: FXD FLM 49.9k 1% 1/8W	0721-4992
R3	R: FXD FLM 24.9k 1% 1/8W	0721-2492
R4	R: FXD FLM 12.4k 1% 1/8W	0721-1242
R5	R: FXD FLM 10k 1% 1/8W	0721-1002
R6	R: FXD FLM 4.99k 1% 1/8W	0721-4991
R7	R: FXD FLM 2.49k 1% 1/8W	0721-2491
R8	R: FXD FLM 1.24k 1% 1/8W	0721-1241
R9	R: FXD FLM 1k 1% 1/8W	0721-1001

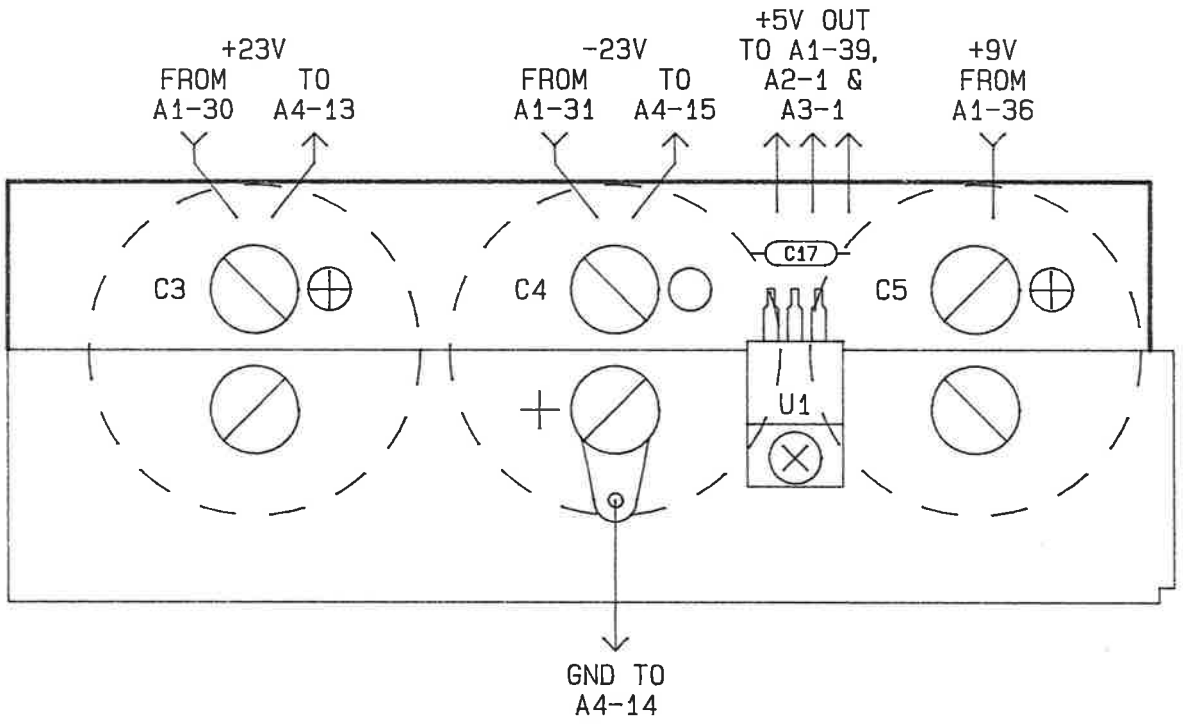
AMM-3V - A4 BOARD

Reference Designation	Description	Part Number
C1	C: FIXED MICA 22pF 5%	0140-2205
C2,C3	C: FIXED ELEC 100uF 35V	0180-0018
C4,C5	C: FIXED CERAMIC 0.001uF 1kV	0151-0002
C6	C: FIXED MICA 22pF 5%	0140-2205
C7,C8	C: FIXED CERAMIC 1.0uF 50V	0151-0008
C9	C: FIXED TANT 15uF 15V	0185-0003
CR1	DIODE: 1N4446	1900-0002
Q1	TRANSISTOR: 2N4401	1850-0028
R1	R: VAR COMP 10k, 10 TURN	2100-0018
R2	R: METAL FILM 1.37k 1%	0721-1371
R3	R: METAL FILM 2.49k 1%	0721-2491
R4	R: METAL FILM 4.99k 1%	0721-4991
R5	R: METAL FILM 2.49k 1%	0721-2491
R6	R: VAR COMP 10k, 10 TURN	2100-0018
R7	R: METAL FILM 1.37k 1%	0721-1371
R8	R: METAL FILM 2.49k 1%	0721-2491
R9	R: METAL FILM 4.99k 1%	0721-4991
R10	R: METAL FILM 2.49k 1%	0721-2491
R11	(NOT USED)	
R12	R: FIXED CARBON 15k 5% ¼W	0683-1535
R13	R: FIXED CARBON 5.1k 5% ¼W	0683-5125
R14	R: FIXED CARBON 75 5% ¼W	0683-7505
R15,R16	R: FIXED CARBON 200 5% ¼W	0683-2015
R17	R: FIXED CARBON 10k 5% ¼W	0683-1035
R18	R: FIXED CARBON 330k 5% ¼W	0683-3345
R19	R: FIXED CARBON 10k 5% ¼W	0683-1035
R20	R: FIXED CARBON 620 5% ¼W	0683-6215
R21	R: FIXED CARBON 1.2k 5% ¼W	0683-1225
RL1	RELAY: DA1a-12V	1600-0003
T1	TRANSFORMER: AUDIO	9100-0016
U1,U2	IC: TL071	1826-0004
U3,U4	IC: NE5534	1826-0025
U5	IC: 7815CT	1826-0031
U6	IC: 7915CT	1826-0033



AMM-3V A4 BOARD
COMPONENT LAYOUT
BELAR ELECTRONICS


POSITIVE METER ADJUST R1 10K
R4 4.99K
+15V
-15V
U1
R2 1.37K
R5 2.49K
TO TB1-10
FROM A1-54
R3 2.49K
TL071
POSITIVE REMOTE METER AMP
R13 5.1K
R11 (NOT USED)
U3
AURAL MONITOR AMP
C4 0.001UF
T1
R15 200
TO TB1-8
R14 75
C2 100UF
C3 100UF
FROM A1-19
R12 15K
C1 22PF
NE5534
R16 200
TO TB1-9
C5 0.001UF
NEGATIVE METER ADJUST R6 10K
R9 4.99K
U2
R7 1.37K
R10 2.49K
TO TB1-11
FROM A1-59
R8 2.49K
NEGATIVE REMOTE METER AMP
R19 10K
R17 10K
U4
R20 620
TO J3
FROM A1-20
R18 330K
C6 22PF
PROOF AMP
RL1
CR1 1N4446
TO TB1-2
TO TB1-3
(N.O.)
FROM A1-60
R21 1.2K
Q1
2N4401
C9 15UF
CARRIER LIMIT ALARM
U5
7815
+24V IN
+15V SOURCE
C7 1.0UF
GROUND FROM CHASSIS
U6
7915
-24V IN
-15V SOURCE
C8 1.0UF
AMM-3V A4 BOARD
BELAR ELECTRONICS



AMM-3V
A5 POWER SUPPLY BOARD
COMPONENT LAYOUT

(USED BEGINNING SERIAL NUMBER 142316V)

SECTION 7

AMM-3 NRSC DE-EMPHASIS MODIFICATION

This modification de-emphasizes the demodulated audio output of the Belar AMM-3 AM Modulation Monitor. With the modification installed, the monitor's audio output frequency response closely approximates the interim NRSC de-emphasis characteristic.

The change effects the audio present at the AUDIO TEST output (J3), the AURAL MONITOR SIGNAL OUTPUT (TB1, screw 11) and the INFORMER OUTPUT (TB1, screw 7).

Parts required:

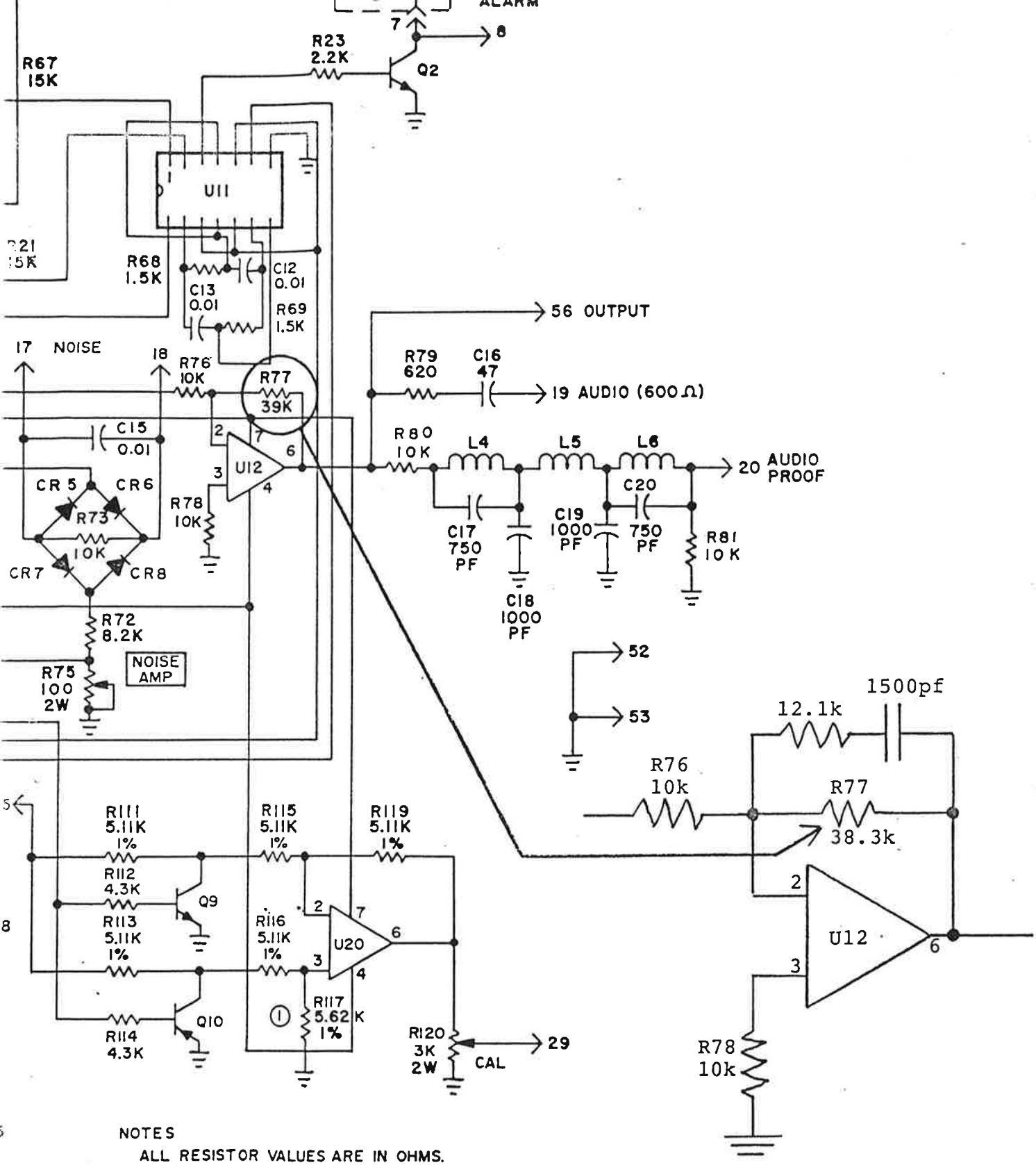
		Belar Part. No.
1	38.3k 1% metal film resistor	0721-3832
1	12.1k 1% metal film resistor	0721-1212
1	1500pF 2.5% 160V poly capacitor	0130-1522

Procedure:

Remove the existing R77 (39k carbon resistor) from the A1 board by cutting the leads as close to the resistor body as possible. (See accompanying component layout sheet for R77 location).

Preform the modification parts by connecting the 12.1k resistor and 1500pF capacitor in series and then connecting these two across the 38.3k resistor as shown on the modification schematic. Use short leads and be careful not to use excessive heat when soldering the parts together.

Mechanically connect the modification network to the original R77 leads on the A1 board. Solder the network to these leads using as little heat as possible so the leads do not pull out of the board. This completes the modification.



NOTES

ALL RESISTOR VALUES ARE IN OHMS.

ALL CAPACITOR VALUES ARE IN MICROFARADS, UNLESS NOTED.

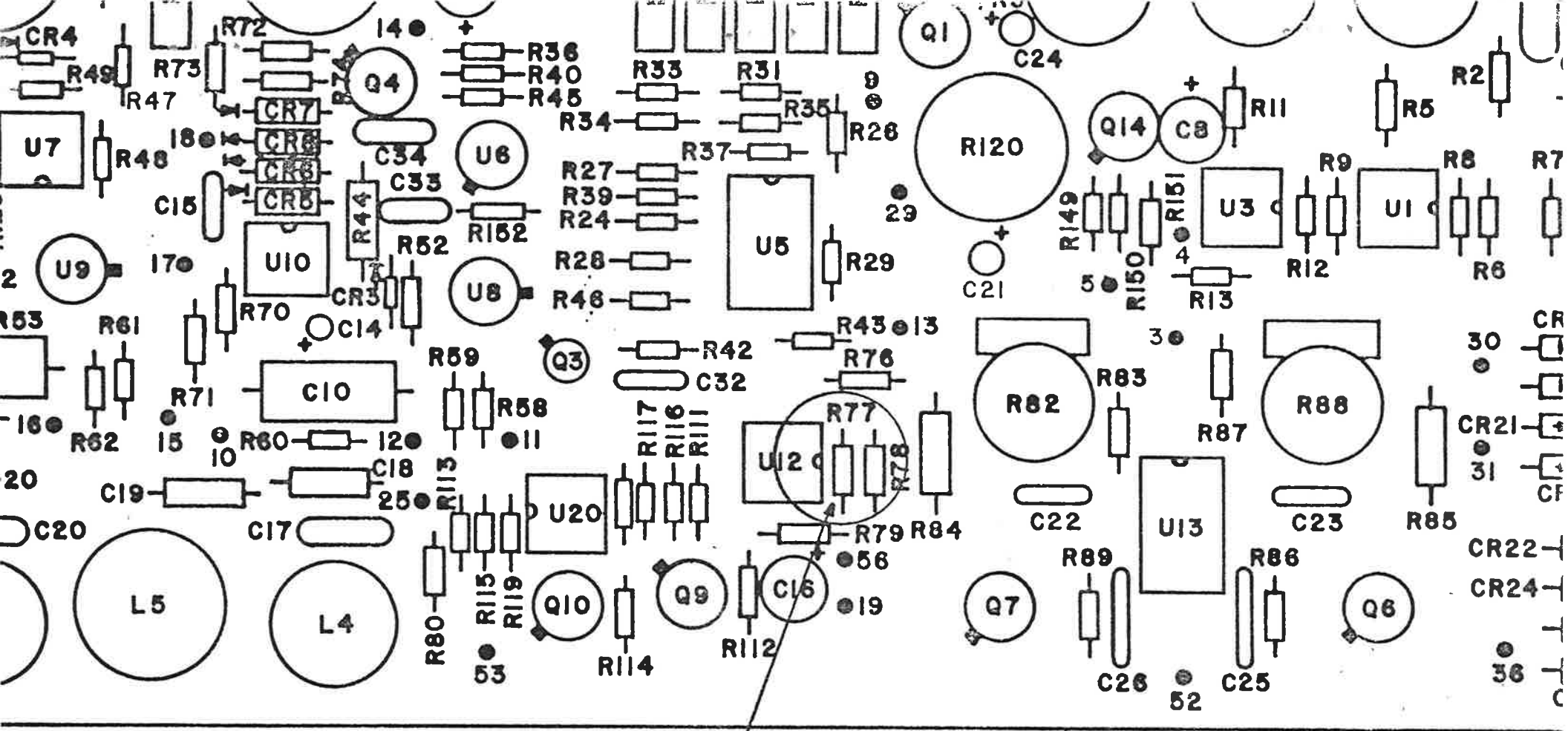
COMPONENTS WITHIN DASHED LINES ARE EXTERNAL TO THE PC BOARD.

(1) VALUE SELECTED IN PRODUCTION, NOMINAL VALUES MAYBE SHOWN.

LAST USED

C35
CR26
L6
Q14

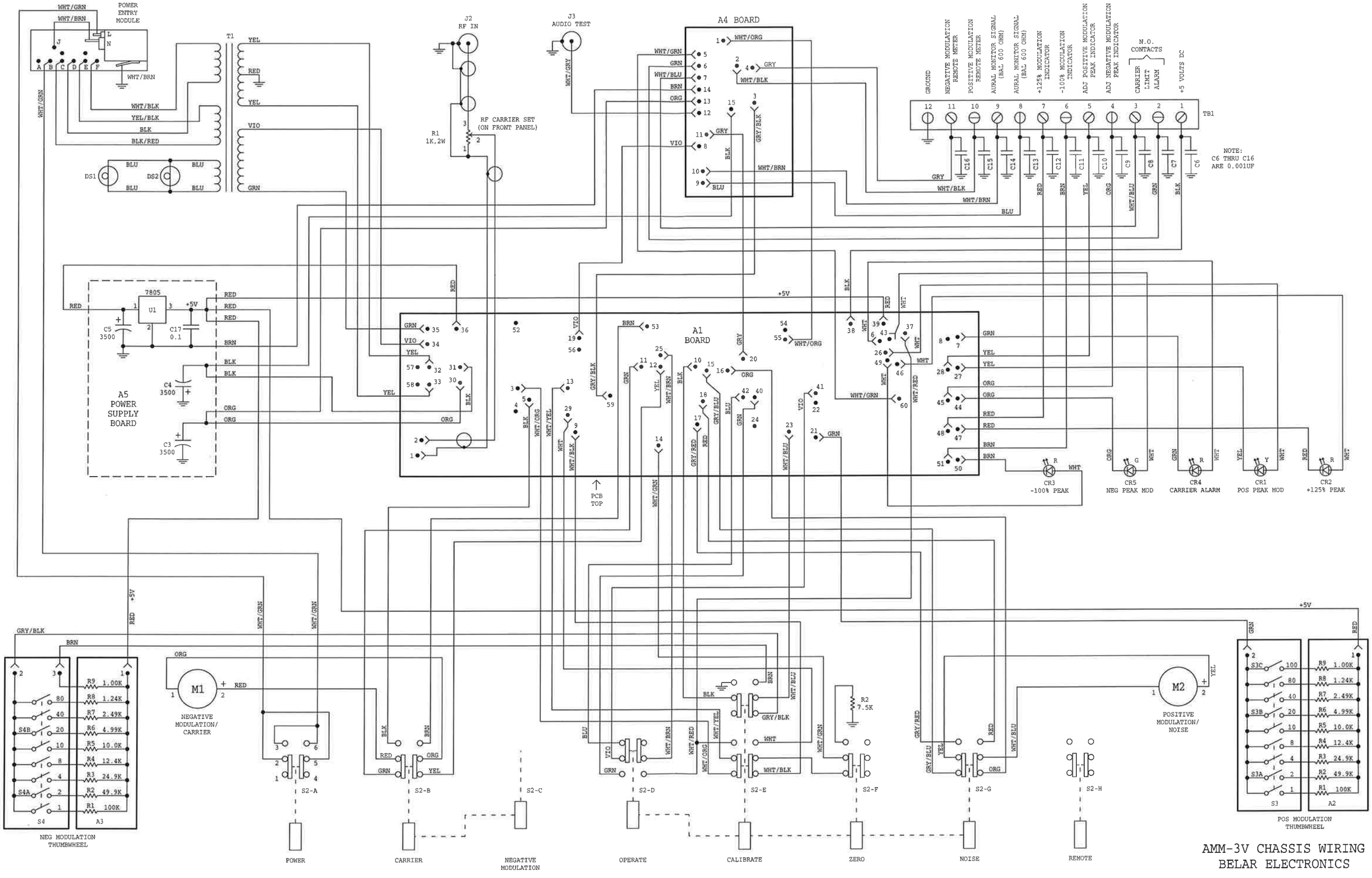
AMM-3 DE-EMPHASIS MODIFICATION
BELAR ELECTRONICS LABORATORY, INC.



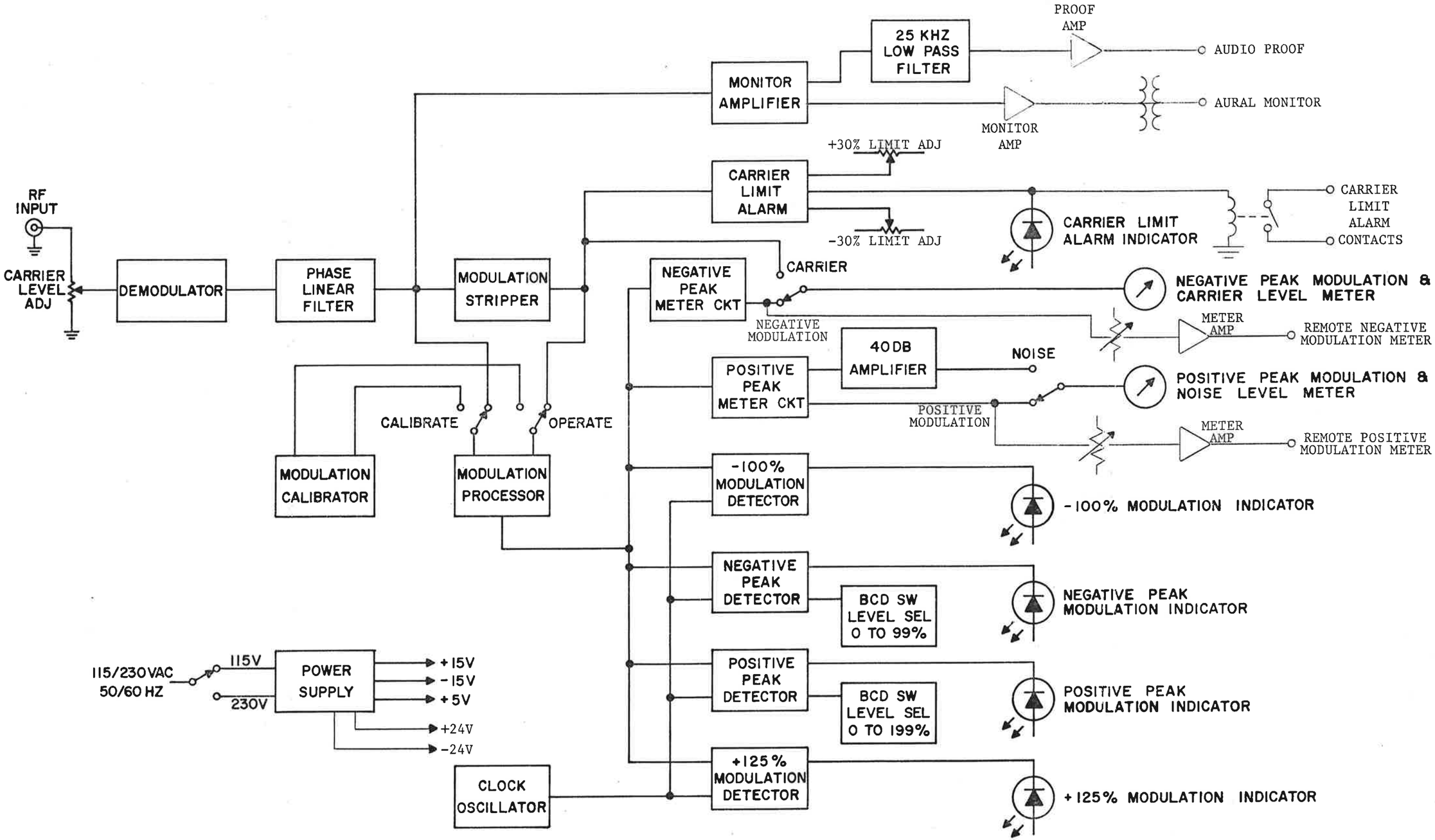
R77 LOCATION

AMM-3 A1 BOARD
DE-EMPHASIS MODIFICATION
BELAR ELECTRONICS LABORATORY, INC.

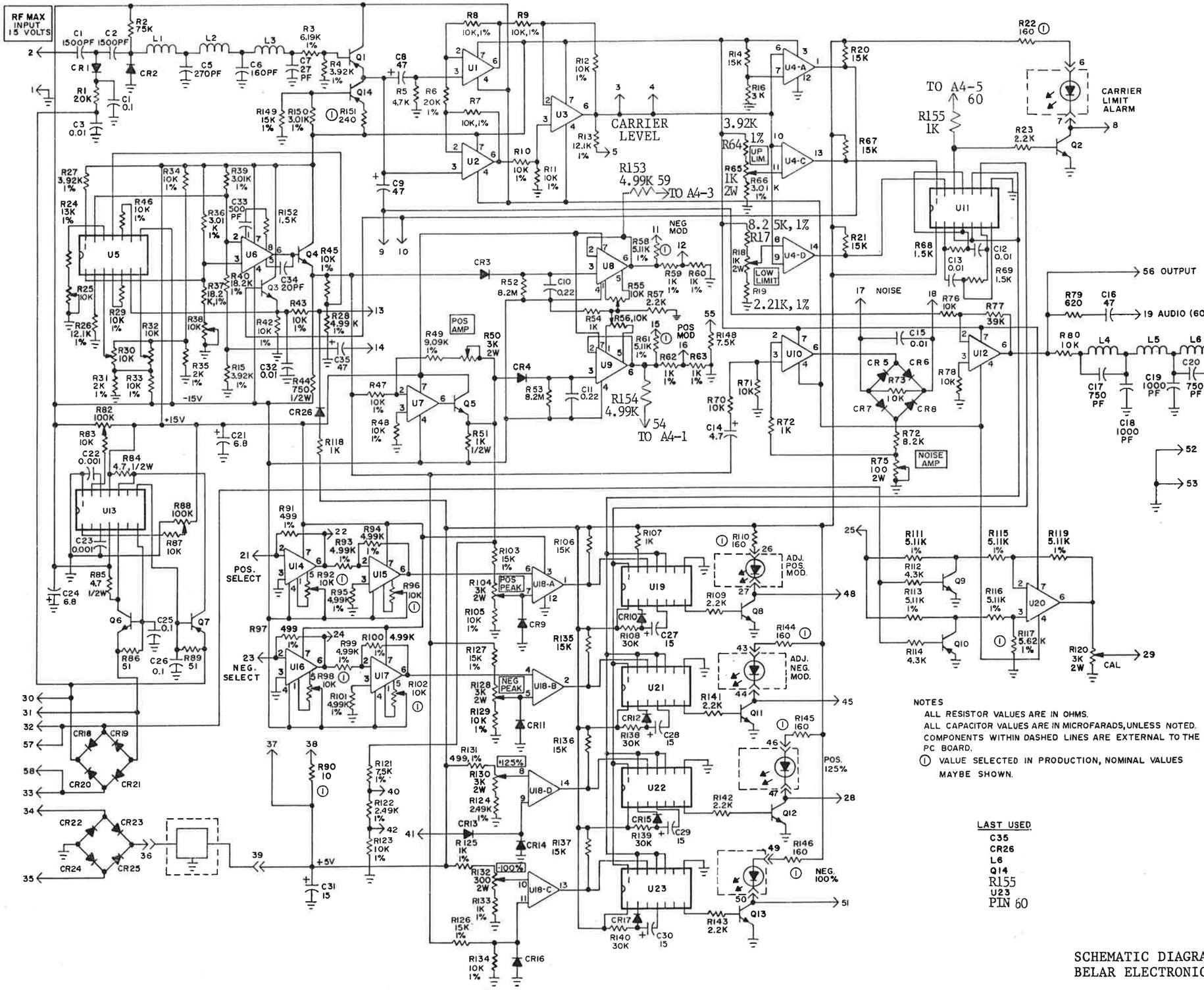
AMM-3
A1 BOARD
BELAR ELECTRONICS
9-1-97



AMM-3V CHASSIS WIRING
BELAR ELECTRONICS



BLOCK DIAGRAM, AMM-3V
BELAR ELECTRONICS LABORATORY, INC.



NOTES

ALL RESISTOR VALUES ARE IN OHMS.

ALL CAPACITOR VALUES ARE IN MICROFARADS, UNLESS NOTED.

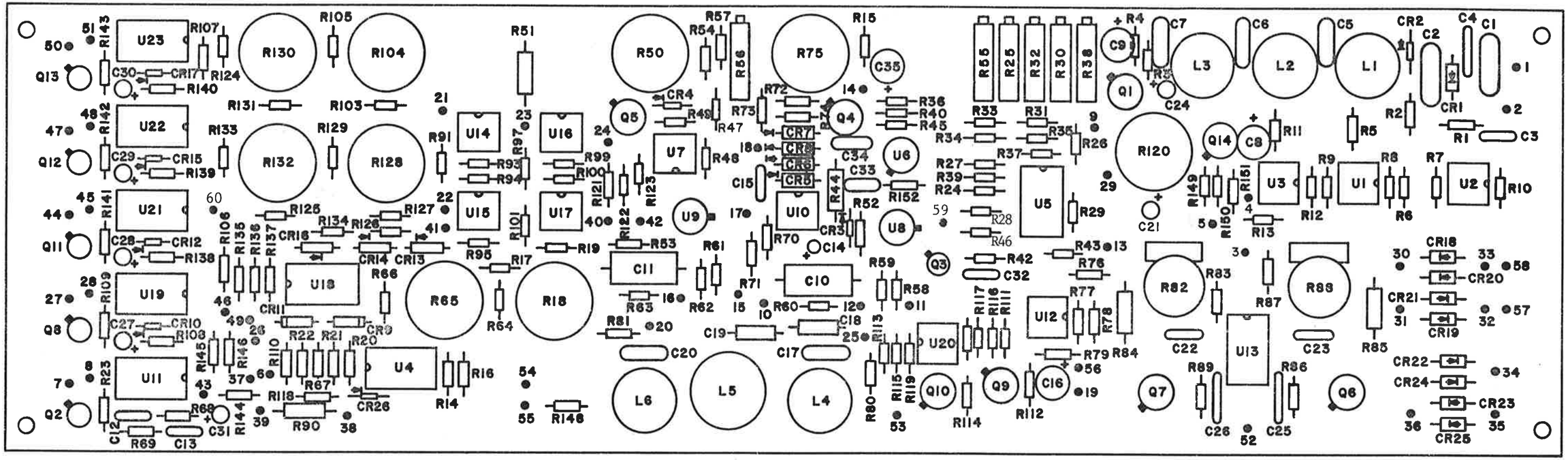
COMPONENTS WITHIN DASHED LINES ARE EXTERNAL TO THE PC BOARD.

① VALUE SELECTED IN PRODUCTION, NOMINAL VALUES MAYBE SHOWN.

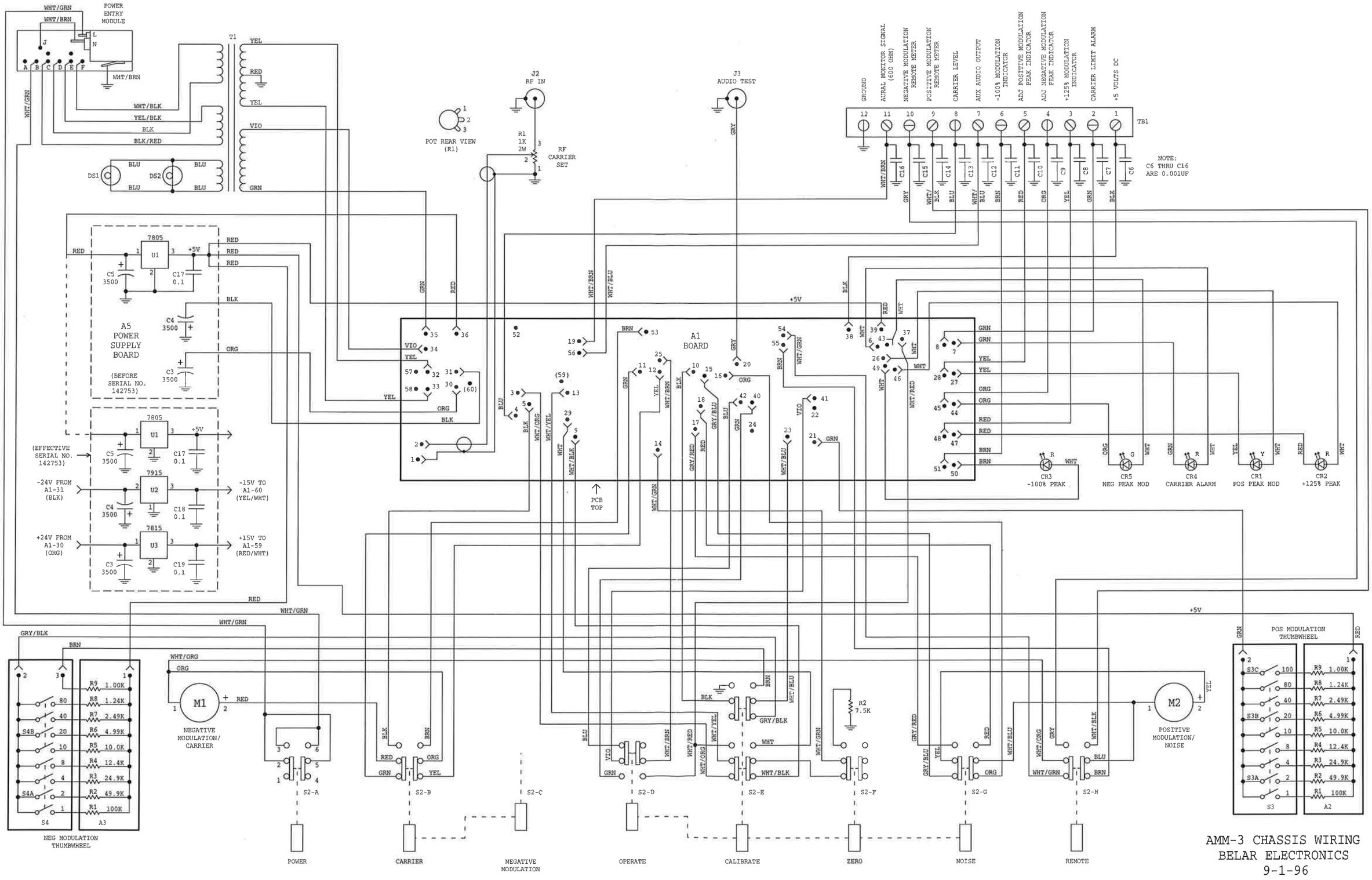
LAST USED

C35
CR26
L6
Q14
R155
U23
PIN 60

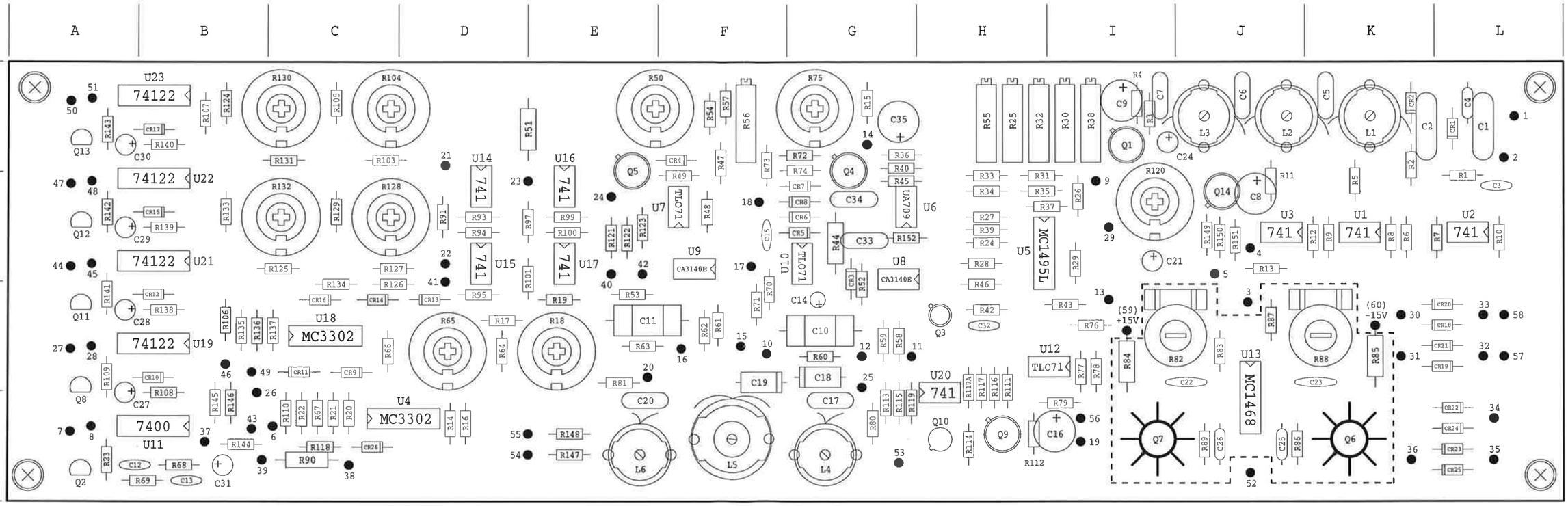
SCHEMATIC DIAGRAM, AMM-3V A1 CARD
BELAR ELECTRONICS LABORATORY, INC.



AMM-3V A1 CIRCUIT CARD COMPONENTS
BELAR ELECTRONICS LABORATORY, INC.

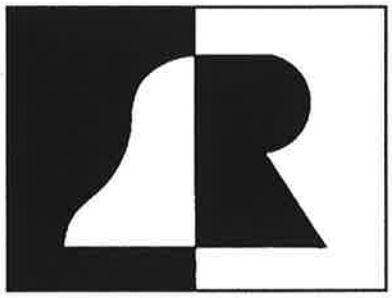


AMM-3 CHASSIS WIRING
BELAR ELECTRONICS
9-1-96



BEGINNING SERIAL NUMBER 142753, THE PARTS INSIDE
THE LINE ARE OMITTED AND PINS 59 & 60 ARE ADDED.

AMM-3 A1 BOARD
COMPONENT LAYOUT
BELAR ELECTRONICS



BELAR

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