INSTRUCTION MANUAL

MODEL 360

TAPE RECORDING ELECTRONICS

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INOVONICS
INCORPORATED

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SECTION 1.0 GENERAL INFORMATION

The Inovonics 360 is a compact single-channel magnetic recording and reproducing electronics assembly with integral power supply. It is intended for direct replacement of Ampex 300, 350 and 351 electronics in applications where the increased reliability, performance and serviceability of modern design is desired.

Among the features incorporated are:

Calibrated positions on Record and Reproduce gain controls.

Provision for remote switching of monitor function (INPUT-TAPE)

Provision for remote switching of equalization (when transport speed switch is provided.)

Bias coupling connector to permit interconnection for stereo operation.

1.1 SPECIFICATIONS

NOTE: Performance of a tape recording system will depend upon the heads and tape used and the effectiveness of head shielding. The specifications below are based on a system using a TABER full track head assembly on an Ampex 350 transport, with 3M 206 tape.

Frequency Response:

15 ips	± 2dB	30-15k Hz
7 1/2 ips	± 2dB	30-12k Hz
3 3/4 ips	+ 2dB,-3dB	30- 8k Hz

Signal-to-Noise Ratio (in dB, referred to 6 dB above 200 nw/m)

	OVERALL		STANDBY	
	unwtd	weighted	unwtd	weighted
15 ips	-66	-72	-76	-83
7 1/2 ips	-69	-74	-76	-83
3 3/4 ips	-65	-72	-72	-79

Erase/Bias Frequency
100 kHz

Erasure
>65 dB erasure of 500 Hz signal recorded 3 dB below saturation.

Amplifier Distortion and Headroom

Record (15 ips pre-emphasis)

<.1% THD 50-10k Hz at operating level
<.2% THD 50-10k Hz 25dB above operating level
Clipping level 28dB above operating level

Reproduce

<.1% THD 50-10k Hz at operating level
<.2% THD 50-10k Hz 15dB above operating level
Clipping level +24dBm

Inputs

Sensitivity: -20 to +8dBm (-8 to +8dBm with transformer)
Impedance: 10k unbalanced (transformer optional)

Outputs

Line Output: feeds 600 line, balanced or unbalanced, terminated or not, at +4 or +8dBm for zero VU.
Headphones: Front panel jack

Power Requirement

105-130 vac, 50/60Hz, .3A (plus transport)

Dimensions

3 ½" x 19" x 9"

Weight

Net	9 lbs
Shipping	17 lbs

2.7 No provision for meter indication of bias or erase current is made, as the inherent stability of the circuity is greater than that of the heads and meter at bias frequencies. A test jack is provided on the rear panel to monitor bias and erase current, if necessary.

2.8 No line termination switch is provided. Output transformer resistance will result in a drop in level of about 1/2dB when the line is terminated in 600 ohms, so the equipment should be connected to its normal load before final calibration.

2.9 When two 360's are employed in two-track machines, such as the Ampex 351-2 or 354, it is necessary to drive both Erase/Bias amplifiers from a single 100kHz signal source to prevent bias "beats". A schematic diagram of the required interconnecting cable is included on the slave chassis, Fig. 5-6-2.

ions.

SECTION 3.0 OPERATION AND FUNCTIONAL DESCRIPTION

3.1 OPERATION

3.1.1 The operating controls are similar in function to those on the Ampex unit being replaced, with the exceptions of the remotable functions discussed in sec. 2.6.

3.1.2 The RECORD GAIN and REPRO GAIN controls are provided with a switched CAL position at full ccw rotation. They are normally left in these positions except for temporary correction for an improperly recorded tape, or abnormal incoming line level. Range is adequate to record from a -20dBm line level (-8 with optional input transformer) and to produce normal line output from a tape under-recorded by 10 dB.

3.1.3 The MONITOR switch determines whether the line amplifier will derive its signal from the incoming signal or the reproduce head, or whether this will be selectable at a remote position.

3.1.4 The EQUALIZATION switch selects HIGH or LOW SPEED equalization or transfers this function to the transport speed switch. It also switches power off in its ccw position.

3.1.5 The RECORD button will place the unit in Record whenever the transport is running. It is illuminated whenever the machine is in record mode.

3.1.6 The PHONES jack is connected to the line output through a 470 ohm resistor. It is suitable for monitoring with headphones or test instruments for service or calibration.

3.2 Circuit Description

3.2.1 Erase/Bias Amplifier

The source of erase/bias signal is an oscillator circuit on the Oscillator/Regulator PCB. The Erase/Bias card has an amplifier to raise this 1-volt signal to the power level required to drive the erase and record heads.

When ground is applied to pin H of the Erase/Bias Amplifier, transistor Q7 saturates. The resulting voltage shift is integrated by R6 and C3 to slowly bring the gate of transistor Q1 from a negative to a positive level. Q1 is a FET connected as a variable "input gain control", and provides the delayed buildup and decay of the erase/bias signal, essential to noise-free "punch-in's".

Transistors Q2, 3, 5, and 6 comprise a class B power amplifier. R2 is factory adjusted to yield an Amplifier output level just short of clipping. Transformer T1 raises the output voltage to an appropriate level for driving the erase head, and secondary taps with jumpers on the PC board permit matching heads of various inductances.

C 13 resonates the erase head at the 100kHz operating frequency, and L1-C 10, C 11, and L2-C 12 form a bias trap to prevent bias voltage from overloading the Record Amplifier.

The Amplifier is self-protected against output overload or mismatch. An excessive increase in current through the output stages, Q5 and Q6, will cause Q4 to conduct. This reduces the Q1 gate drive, and hence the input signal. Test points TP 1 and 2 provide a convenient point for monitoring the DC current, typically 50-120mA (0.5 - 1.2v DC as measured with a Volt-Ohmmeter).

3.2.2 Record Amplifier

An input signal to the Record Amplifier first passes through the REC GAIN control and into a 30kHz active low-pass filter. This filter, consisting of R2-C2, R3-C3, and IC 1, removes RF and other spurious signals outside the audio band which otherwise could cause high frequency overloading during recording.

The signal then passes through the high frequency

equalizer consisting of R8 and C6 or C7, depending upon the operating speed. The signal is routed to the appropriate variable capacitor by the application of +20 volts on the control lead of the associated FET switch, Q2 or Q3. IC2 provides voltage gain to the now attenuated and equalized input signal, and provides the NAB low frequency pre-emphasis.

The signal is then fed to IC3, a constant-current-source output stage. A switching circuit consisting of Q5 and relay K1 connects the record head to the output of IC3 in the RECORD mode. The NOISE BAL control, R34, permits introduction of a small DC offset to the record head for the purpose of nulling any second harmonic distortion which may appear in the recorded signal as result of magnetic fields near the record head.

3.2.3 Reproduce

Resistor R1, directly across the amplifier input, may be used to damp the LC resonance of the cable and head.

Transistor Q1 and Q2 with their associated components constitute a low-noise input amplifier. An emitter follower, Q3, isolates the low-current input stages from their load. FET'S Q5 and Q6 switch the proper equalization network into the input amplifier feedback loop for the selected speed. When an equalization control lead is connected to +20 volts, the associated equalization components are connected into the circuit.

3.2.4 Line Amplifier

The line amplifier receives signals from the Reproduce Amplifier (TAPE monitor) and the Record Amplifier (INPUT monitor). FET switches Q1 and Q3 direct the selected signal to the line amplifier input when the proper control lead is grounded, either by the front panel Monitor switch or through the Accessory connector.

Integrated circuit IC1 performs the voltage gain function of the line amplifier. Transistors Q4, Q5 and their associated components provide the output current required for

driving low impedance loads and long cables. Protection from output short circuits is afforded by diodes CR2 and CR3.

Transformer T1 (chassis-mounted) provides output isolation. This unit has a near-unity ratio, and can be removed from the circuit, if desired, with no loss in performance.

3.2.5 Bias Oscillator and Power Supply Regulator

This card contains two separate sections; the bias oscillator which feeds the Bias Amplifier, and the +20 and -20 volt power supplies.

Transistors Q1 and Q3 provide the voltage amplification required to sustain oscillation of the Bias Oscillator circuit. The resonant circuit L1-C1 determines the operating frequency. Q4 and Q5 comprise the output amplifier, and Q6 and its associated components constitute a gated current source to supply the proper amount of positive feedback to the amplifier input and provide an AGC function to maintain constant output amplitude.

Transistor Q2 limits current to the amplifier and protects the output stages in the event of an output short circuit.

Type 723 integrated circuits are employed as both positive and negative voltage regulators. Aside from precision voltage dividers which determine the supply voltage, regulator IC1 requires only Q7 and a chassis-mounted power device to form the positive supply.

The negative supply includes Q8 for output short circuit protection; otherwise, it is an inverted version of the positive regulator. Q9 and a chassis-mounted power device complete the negative supply.

SECTION 4.0 ALIGNMENT AND MAINTENANCE

4.1 Routine Calibration

4.1.1 Equipment Required:

Head Demagnetizer
Appropriate Reproducer Alignment Tapes
Audio Oscillator
AC Voltmeter

4.1.2 REPRODUCE

4.1.2.1 Place MONITOR switch in INPUT position. Clean and demagnetize all heads, moving very slowly while the demagnetizer in near the heads, and withdrawing it about a yard from the head assembly before unplugging it.

4.1.2.2 Place MONITOR switch in TAPE position and thread an alignment tape appropriate for the equalization to which the electronics is switched.

4.1.2.3 While reproducing the highest frequency on the tape, adjust reproduce head azimuth for maximum output.

4.1.2.4 If the resonance of the reproduce head with its cable is near the top of the passband (as is usually the case for best signal-to-noise performance), a peak in response will be observed at the highest frequencies. R1 on the Reproduce Amplifier card is provided to damp this resonance. To determine whether its value is correct for the head used, set High Speed H.F. control so that 5k Hz playback is flat with respect to the reference frequency tone on the alignment tape. Note response at the highest frequencies, and raise the value of R1 to increase, or lower to decrease, this level.

4.1.2.5 Set H.F. control for smoothest response from reference frequency to highest frequency.

4.1.2.6 If alignment tape track width is the same as reproducer track width, set L.F. control for smoothest response from reference frequency to lowest frequency. If not, as with full track tape and half track reproduce head, wait until step 4.1.4.4 to trim this control.

4.1.2.7 Repeat the preceding two steps for the other speed. It is advisable to make final azimuth setting at the lowest speed to be used.

4.1.2.8 Turn front panel REPRO GAIN control fully ccw to CAL position, and adjust R34 PB GAIN on Reproduce card for an **indication** of zero VU while reproducing a reference tone recorded to the desired operating level. If it is wished to operate into a +8 dBm line, remove the jumper close to Q4 on the Line Amplifier before making this adjustment.

4.1.3 ERASE/BIAS

4.1.3.1 The Model 360 is designed to operate with an erase head in the 1.2 to 1.8mHy inductance range. If a head of lower inductance is intended tor use, remove the shorting strap in place of L5 on the Erase/Bias Amplifier PC board and install a choke coil, the inductance of which, when added to the erase head inductance, will equal 1.5mHy.

4.1.3.2 Place MONITOR switch in TAPE position, connect an audio oscillator to the INPUT socket, and thread transport with a good sample of the type of tape to be used subsequently.

Place machine in record mode at 15 ips and adjust input to 1 kHz at about operating level; adjust R13 BIAS control for maximum reproduced signal. (Use 500 Hz at 7 1/2 ips on 7 1/2-3 3/4 ips units)

4.1.4 RECORD

4.1.4.4 With conditions as for 4.1.3.3 above, place recorder in record mode at higher speed and set input signal to 700 Hz at +4 dBm (+8 dBm if reproduce was calibrated for this level). Reduce level by about 10 dB if the case of 7 1/2-3 3/4 ips. units.

4.1.4.2 Raise the frequency to 15 kHz and adjust the record head azimuth for maximum output.

4.1.4.3 Set record pre-emphasis by adjusting C7 Record HI SPD control for smoothest response from reference frequency up.

4.1.4.4 If incompatibility of alignment tape track width to reproducer track width prevented setting reproduce L.F. controls in paragraph 4.1.2.6, adjust the HI SPD L.F. control now for flattest overall response.

4.1.4.5 Set equalization for lower speed, using C6, LO SPD and reproduce LO SPD L.F. adjustments as above, first reducing input level by 10 dB.

4.1.4.6 Switch front panel RECORD GAIN and REPRO GAIN controls fully ccw to CAL position. With input of normal line level and of the same frequency as the reference tone on the alignment tape used, set R1 REC GAIN on Record card for an indication of zero VU on the meter.

4.1.4.7 With MONITOR switch in INPUT position, adjust R7 REC GAIN control for an indication of zero VU on the meter.

4.1.4.8 Turn RECORD GAIN slightly clockwise (just out of CAL position), and monitor TAPE output in record mode at high REPRO GAIN setting. Adjust R34 NOISE BAL control on the Record card for minimum noise.

4.2 SERVICE NOTES

4.2.1 Lamp Replacement

4.2.1.1 Meter Lamps - The meter is illuminated by two long life #388 lamps, which are considerably under-voltaged. In the event it becomes necessary to replace one, remove the top cover and the two meter terminal nuts securing the Line Amplifier. Slide the PC card off the meter studs and remove the 3/16" hex threaded spacer retaining the socket of the burned out lamp.

4.2.1.2 Record Indicator Lamp - Pry off the RECORD button with a fingernail or small screw driver in the slots at the top and bottom of the button. Carefully withdraw the slide base lamp thus exposed.

4.2.2.2 PC Card Removal - The Reproduce, Record, and Erase/Bias Amplifier Cards are provided with a dummy terminal near the right front edge of the card. A small screwdriver or nut driver may be used to pry the card free of its connector by these terminals. The Line Amplifier card is mounted to the rear of the meter on two 10/32 studs. The Oscillator/Regulator card is removed by extracting four 4-40 screws from the outside of the chassis, slipping off the edge connector and sliding the board, with its spacers attached, out of the chassis.

4.2.3 Regulator Transistor - These are mounted on the side of the chassis next to the OSC/REG card. In the event it is necessary to replace them, be sure that the mica washer and fiber shoulder washer are in place, and a suitable thermal compound used on both sides of the mica washer. The leads of the transistors are vulnerable to damage from strain or **flexing; exercise care** in handling and installation.

STEREO OPERATION

OF THE

INOVONICS MODEL 360

Two Inovonics Model 360 Tape Electronics may be interconnected for two-channel (stereo) operation. When ordered for such use (as for replacement service in Ampex 351-2 and 354 recorders), one 360 is supplied in a standarad configuration, and the other as a "slave" amplifier, less power cord. Necessary cables are also supplied for erase/bias and transport logic interconnection.

Connection:

1. Mount the two 360's, standard unit above, "slave" unit below, and connect to track 1 and 2 heads, respectively.

2. Interconnect the BIAS COUPLING jacks with the cable provided.

3. Interconnect the 6-pin TRANSPORT connectors with the "Y" cable provided, and plug the transport into the remaining female cable socket.

Operation:

1. AC power for both 360's and the transport is switched with the upper (channel 1) power switch. HOWEVER, it is necessary to switch equalization on BOTH 360's when the tape speed is changed.

2. Either channel may be placed into the Record mode by pressing the appropriate front panel RECORD button. Both buttons must be pressed for stereo recording. NOTE: if the transport is equipped with a Remote Control panel, the remote RECORD button will place both channels into the Record mode.

SCHEMATIC REF. NO.	PART NUMBER	DESCRIPTION	MFG.	MANUFACTURER PART NUMBER
	119202A	ERASE & BIAS AMPLIFIER PCB ASS'Y (SCHEMATIC 118002)		
	2600	Heat Dissipating Fins	Wakefield	207-AB
C 1,3,5,7	0867	Capacitor, 0.1 uF, 100V	Sprague	225P10491
C 2,4,6,8	0862	" 0.01 uF, 100V	Sprague	225P10391
C 9	0827	" 300 pF, mica	Elmenco	DM15-301J
C 10	0829	" 3000 pF, mica	Elmenco	DM19-302J
C 11	0822	" 1000 pF, mica	Elmenco	DM19-102J
C 12	0834	" 2700 pF, mica	Elmenco	DM19-272J
C 13	0825	" 1800 pF, mica	Elmenco	DM19-182J
CR 1,2	1100	Diode, Silicon, 1N4009	Fairchild	
L 1,2	1403	Inductor, 1 mHy	Delevan	2500-28
	1409	" 220uHy	"	1537-92
Q 1	1211	Transistor, F.E.T. MPF 111	National	
Q 2,3,4	1204	" 2N3567	Fairchild	
Q 5	1200	" 2N2102	National	
Q 6	1212	" 40319	RCA	
Q 7	1205	" 2N3645	Fairchild	
R 1	0169	Resistor, ¼W, 10%, 4.7k		
R 2	0558	Resistor, Variable, 10k	Helipot	91A10K
R 3,8,12,13,18	0161	Resistor, ¼W, 10%, 1k		
R 4,5,7,19	0173	" 10k		
R 6	0203	" 3.3 Meg		

SCHEMATIC REF. NO.	PART NUMBER	DESCRIPTION	MFG.	MANUFACTURER PART NUMBER
R 9	0163	Resistor, ¼W, 10%, 1.5k		
R 10	0186	" 120k		
R 11	0143	" 33 ohms		
R 14	0421	" , ½W, 10%, 1.5 ohms		
R 15	0178	" , ¼W, 10%, 27k		
R 16	0175	" " " 15k		
R 17	0177	" " " 22k		
R 20	0513	Resistor, Variable, 10k	Helipot	89PR10k
R 21	0137	Resistor, ¼W, 10%, 10 ohms		
T 1	119300	Transformer, Bias		
	105202B	RECORD AMPLIFIER PCB ASS'Y, 7½-15 ips (SCHEMATIC 110100)		
C 1	0904	Capacitor, 25 uF, 25V	Sprague	TE 1207
C 2	0827	" 300 pF, mica	Elmenco	DM15-301J
C 3	0812	" 150 pF, mica	Elmenco	DM15-151J
C 4,12,18	0801	" 10 pF, mica	Elmenco	DM15-100J
C 6	1004	Capacitor, Variable, 37-250 pF	Elmenco	426
C 7	1007	" " 170-600 pF	Elmenco	4213
C 9,10,19	0867	Capacitor, 0.1 uF, 100V	Sprague	225P10491
C 15	0836	" 300 pF, mica	Elmenco	DM19-301J
C 11	0810	" 100 pF, mica	Elmenco	DM15-101J

SCHEMATIC REF. NO.	PART NUMBER	DESCRIPTION	MFG.	MANUFACTURER PART NUMBER
C 13	0871	Capacitor, 0.156 uF, 100 V	Sprague	225P56391
C 16	0905	" 50 uF, 3 V	Sprague	TE 1058
C 17,20	0901	" 5 uF, 25 V	Sprague	TE 1202
CR 3,4	1100	Diode, Silicon, 1N4009	Fairchild	
CR 5	1102	Diode, Zener, 15 V 10%	Motorola	1N5245A
IC 1,2,3	1300	Integrated Circuit, Type 748	Signetics	5748V
K1	1908	Relay, SPST, 12 V, DIP Pkg	Sigma	191TE1A1-12G
Q 2,3,5	1211	Transistor, F.E.T., MPF 111	Motorola	
Q 6	1205	" 2N3645	National	
R 1,7,34	0510	Resistor, Variable, 10K	Beck/Helipot	89PR10K
R 2,3,5	0175	" ¼W, 10%, 15K		
R 4,27	0070	" " 5%, 3K		
R 6, 24	0173	" " 10% 10K		
R 8,15,16,18 19,26	0185	" " " 100K		
R 9	0167	" " " 3.3K		
R 11,12	0189	" " " 220K		
R 13	0080	" " 5% 7.5K		

SCHEMATIC REF. NO.	PART NUMBER	DESCRIPTION	MFG.	MANUFACTURER PART NUMBER
R 24	0184	Resistor, ¼W, 10% 83K		
R 25	0101	" " 5% 62K		
R 29,30,32	0083	" ", " 10K		
R 31	0082	" " " 9.1K		
R 33,40	0161	" " 10% 1K		
R 35	0191	" " " 330K		
R 36	0380	" ½W, " 470 ohms (not used with 24 V K1)		
R 38	0171	" ¼W, " 6.8K		
R 39	0177	" " " 22K		
R 41	0193	" " " 470K		
	105303B	RECORD AMPLIFIER PCB ASS'Y, 3 3/4 - 7 1/2 ips (SCHEMATIC 110101)		
		Same Except:	Elmenco	4213
C 7	1007	Capacitor, Variable, 170-600pF	Elmenco	DM15-301J
C 21	0827	Capacitor, 300 pF mica		
	105301B	REPRODUCE AMPLIFIER PCB ASS'Y (SCHEMATIC 110200)		
C 1	0904	Capacitor, 25 uF, 25 V	Sprague	TE 1207
C 2	0810	" 100 uF, mica	Elmenco	DM15-101J
C 3	0906	" 100 uF, 3 V	Sprague	TE 1059.5
C 5,6	0862	" 0.01 uF, 100 V	Sprague	225P10491
C 12	0801	" 10 pF, mica	Elmenco	DM15-100J
C 13	0901	" 5 uF, mica	Sprague	TE 1202
CR 1	1100	Diode, Silicon, 1N4009	Fairchild	
IC 2	1300	Integrated Circuit, Type 748	Signetics	5748V
C 8,9	0867	Capacitor, 0.1 uF, 100 V	Sprague	225P10391

SCHEMATIC REF. NO.	PART NUMBER	DESCRIPTION	MFG.	MANUFACTURER PART NUMBER
Q 1	1210	Transistor, SE 4010	National	
Q 2	1205	" 2N3645	National	
Q 3	1209	" 2N5308	G.E.	
Q 5,6	1211	" F.E.T., MPF 111	Motorola	
R 1	0189	Resistor, ¼W, 10% 220K		
R 2	0151	" " " 150 ohms		
R 3	0192	" " " 390K		
R 4	0161	" " " 1K		
R 5	0153	" " " 220 ohms		
R 7,34	0510	Resistor, Variable, 10K	Beck/Helipot	89PR10K
R 8	0511	" " 20K	Beck/Helipot	89PR20K
R 9,35	0173	Resistor, ¼W, 10%, 10K		
R 10,15	0169	" " " 4.7K		
R 11	0112	" " 5% 200K		
R 13,14	0519	Resistor, Variable, 2 Meg	Beck/Helipot	89PR2meg
R 16	0196	" ¼W, 10%, 820K		
R 18,19	0189	" " " 220K		
R 23,24,27,28	0185	" " " 100K		
R 25	0055	" " 5% 620 ohms		
R 31	0073	" " " 3.9K		
R 32	0070	" " " 3K		
R 33	0076	" " " 5.1K		

SCHEMATIC REF. NO.	PART NUMBER	DESCRIPTION	MFG.	MANUFACTURER PART NUMBER
	105101A	LINE AMPLIFIER PCB ASS'Y (SCHEMATIC 114500)		
C 1,3	0867	Capacitor, 0.1 uF, 100 V	Sprague	225P10491
C 4	0901	" 5 uF, 25 V	Sprague	TE1202
C 5,6	0801	" 10 pF, mica	Elmenco	DM15-100J
CR 1,2,3,4	1100	Diode, Silicon 1N4009	G.E./Fairchild	
IC 1	1300	Integrated Circuit, Type 748	NSC/Fairchild	
Q 1,3	1211	Transistor, F.E.T., MPF 111	Motorola	
Q 4	1204	" 2N3567	NCS/Fairchild	
Q 5	1205	" 2N3645	NCS/FAIRCHILD	
R 1,3	0189	Resistor, ¼W, 10% 220K		
R 4,6,7,9,10	0185	" " " 100K		
R 11	0173	" " " 10K		
R 12	0187	" " " 150K		
R 13,14	0168	" " " 3.9K		
R 15,16	0137	" " " 10 ohms		
R 17	0068	" " 5% 2.4K		
R 18	0072	" " " 3.6K		
R 19	0157	" " 10% 470 ohms		
R 20,22	0169	" " " 4.7K		

SCHEMATIC REF. NO.	PART NUMBER	DESCRIPTION	MFG.	MANUFACTURER PART NUMBER
	105001B	OSCILLATOR & REGULATOR PCB ASS'Y (SCHEMATIC 102901)		
C 1	0860	Capacitor, 0.0068 uF, 100V	Sprague	225P68291
C 2	0827	" 300 pF, mica	Elmenco	DM15-301J
C 3,6,7	0867	" 0.1 uF, 100 V	Sprague	225P10491
C 4	0810	" 100 pF, mica	Elmenco	DM15-101J
C 5,8,9	0850	" 0.001 uF, 100 V	Sprague	225P10291
C 11,12	1050	" 4.7 uF, 35 V tantalum	Kemet	T310B475K035
CR 1,2,3	1100	Diode, Silicon 1N4009	Fairchild/GE	
CR 4,5	1125	" " 1N4005	Motorola	
IC 1,2	1301	Integrated, Circuit, Type 723-C	Fairchild/Signetics/TELEDYNE	
L 1	1406	Inductor, Adjustable, 350-430 uH	J.W. Miller	46A394CPC
Q 1	1210	Transistor, SE 4010	NSC, Fairchild	
Q 2,3,6,8	1205	" 2N3645	RCA	
Q 4,7	1200	" 2N2102	RCA	
Q 5,9	1212	" 40319	RCA	
R 1	0179	Resistor, ¼W, 10% 33K		
R 2	0188	" " " 180K		
R 3,4	0155	" " " 330 ohms		
R 5	0070	" " 5% 3K		
R 6	0133	" " 10% 4.7 ohms		

SCHEMATIC REF. NO.	PART NUMBER	DESCRIPTION	MFG.	MANUFACTURER PART NUMBER
R 7,14,15	0161	Resistor, ¼W, 10% 1K		
R 8,9	0137	" " " 10 ohms		
R 10	0173	" " " 10K		
R 11	0149	" " " 100 ohms		
R 12	0510	Resistor, Variable, 10K	Beck/Helipot	89PR10K
R 13	0180	" ¼W, 10%, 39K		
R 16	0454	Resistor, Metal Film, ½W, 1% 16.2K T-1	Corning	NA65
R 17	0451	" " " " " 3.57K T-1	Corning	NA65
R 18	0074	" ¼W, 5%, 4.3K		
R 19,20	0450	" Metal, Film, ½W, 1% 3.01K T-1	Corning	NA65
R 21	0452	" " " " " 7.15K T-1	Corning	NA65
R 22	0386	" ½W, 10%, 1.5K		
R 23	0453	" Metal, Film, ½W, 1% 12.7K		
R 24	0053	" ¼W, 5%, 510 ohms		

SCHEMATIC REF. NO.	PART NUMBER	DESCRIPTION	MFG.	MANUFACTURER PART NUMBER
		CHASSIS COMPONENTS (SCHEMATIC 110700)		
C 1	0907	Capacitor 100 uF, 25 V	Sprague	TE 1211
C 2,3	0910	" 500 uF, 50 V	Sprague	TVA 1315
C 4,5	0872	" , 0.01 600 V	Sprague	6PS-S10
CR 1-5,8	1125	Diode, Silicon 1N4005	Fairchild	
CR 6,7	1100	Diode, 1N4009	Fairchild	
F 1	2702	Fuse 3AG ½A		
F 2	2706	Fuse 3AG 3A		
I 1	2005	Lamp 24 V Slide Base	Unimax	01-903 24 V
I 2,3	2000	Lamp #388		
K 1	1902	Relay 2 PDT 110 V DV	P & B Eagle-Signal	KA11DY 110 25A-2C-D110
Q 1,2	1213	Transistor 2N5294	RCA	
Q 3,4	1205	Transistor 2N3645	National	
R 1,5	0600	Potentiometer 100K CW log w/switch	Allen-Bradley	JS1N200P104AA
R 2,13	0177	Resistor ¼W, 10% 22K		
R 3,4	0137	" " " 10		
R 6	0181	" " " 47K		
R 7,8	0421	" ½W, " 1.5 ohms		
R 9,11	0180	" ¼W, " 39K		
R 10	0192	" " " 390K		

SCHEMATIC REF. NO.	PART NUMBER	DESCRIPTION	MFG.	MANUFACTURER PART NUMBER
C 12	0171	Resistor ¼W, 10% 6.8K		
	0188			
			Centralab	1465
S 2	1810	Switch, Power and Equalization	Centralab	PA 1000
S 3	1809	Switch Monitor	Unimax	01-121
S 5	1805	Switch Record P.B.	Unimax	01-901 R
	1806	Cap		
T 1	101090	Transformer, Output		
T 2	110800	Transformer, Power	UTC	0-37
T 3	1502	Transformer, Input (Optional)	UTC	0-17
	1503	Shield for 1502		

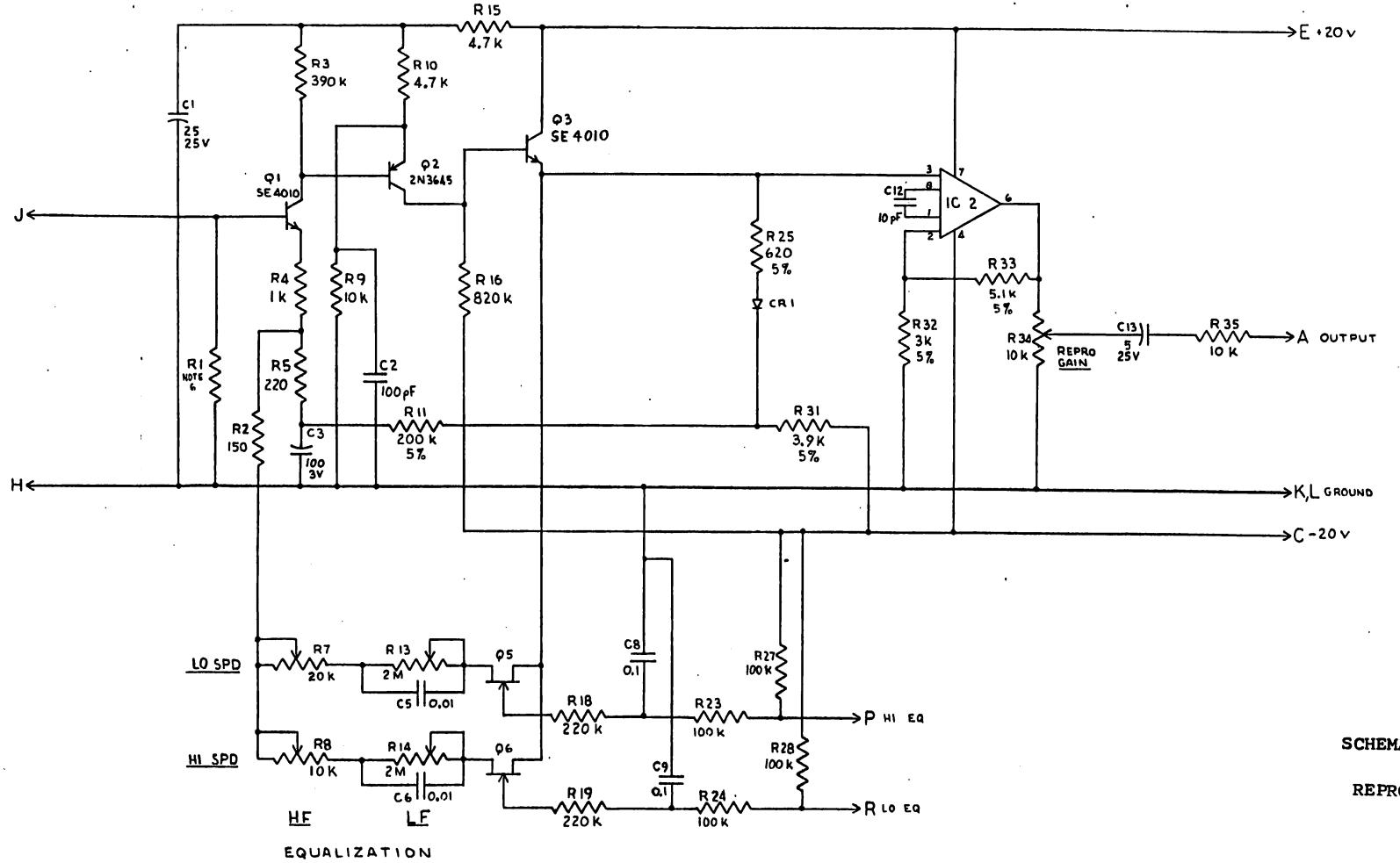
NOTES:

UNLESS OTHERWISE SPECIFIED

1. ALL FIXED RESISTORS ¼ WATT 10%, VALUE IN OHMS
2. ALL CAPACITANCE VALUES IN μF
3. ALL DIODES, TYPE IN4009
4. ALL IC's TYPE 748
5. ALL FET's TYPE MPF 111
6. SELECTED FOR BEST H.F. RESPONSE

LAST USED REF DESIG
C 13
CR 1
IC 2
Q 6
R 35

REF DESIG. NOT USED
C 4,7,10,11
IC 1
Q 4
R 6,12,17,30 20-22,26,29



SCHEMATIC, A/N 105301B

REPRODUCE AMPLIFIER

Fig. 5-1

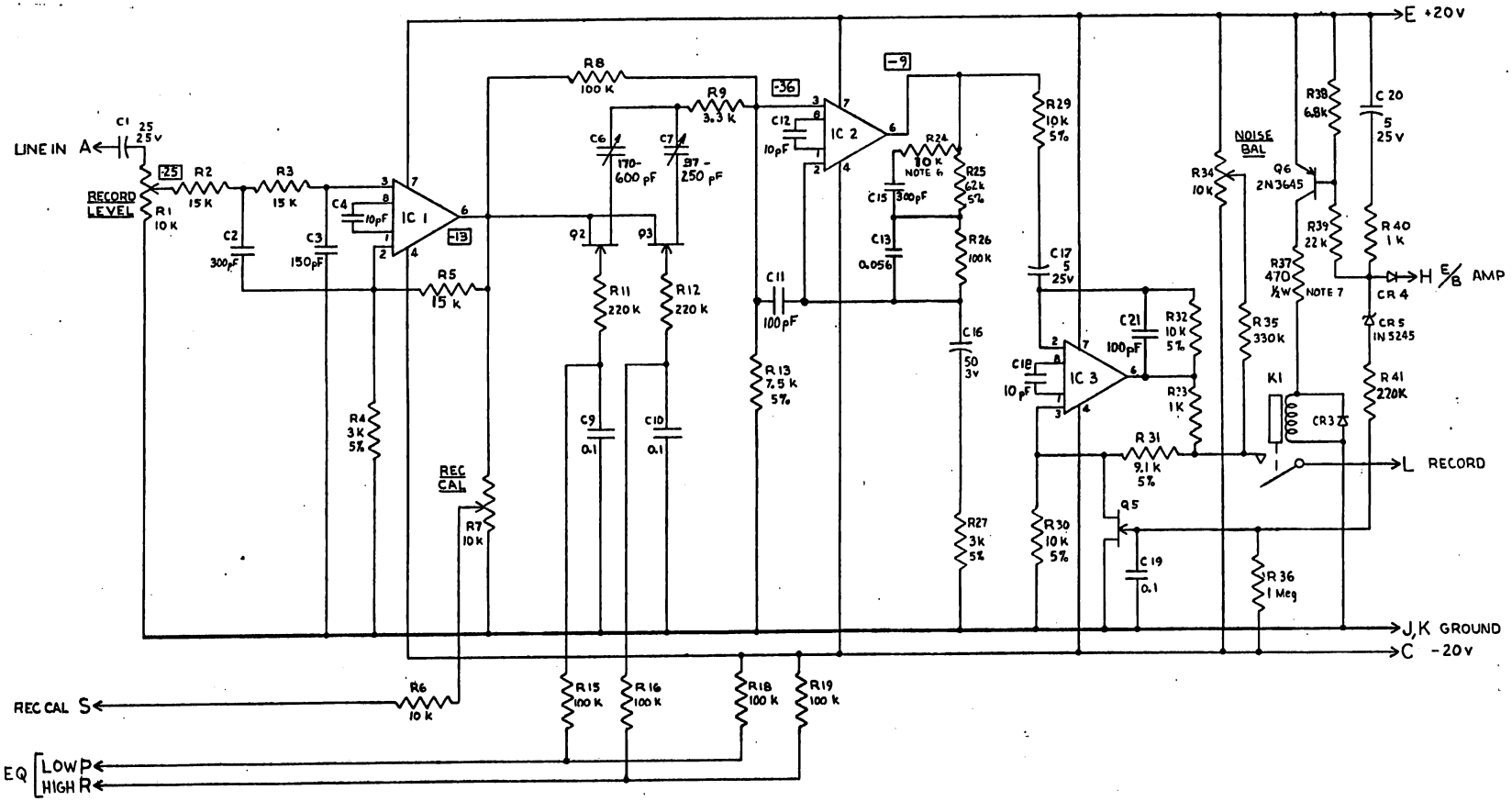
NOTES:

UNLESS OTHERWISE SPECIFIED

1. ALL FIXED RESISTORS ¼ WATT 10%, VALUE IN OHMS
2. ALL CAPACITANCE VALUES IN μF
3. ALL DIODES TYPE IN4009
4. ALL IC's TYPE 748
5. ALL FETS TYPE MPF 111
6. R24 MAY BE DELETED FOR SMOOTHEST RESPONSE WITH OLDER HEADS
7. R37 USED ONLY WITH 12 V K1

LAST USED REF DESIG
C 20
CR 5
IC 3
K 1
Q 6
R 41

REF DESIG NOT USED
C 5,8,14
CR 1,2
Q 1,4
R 10,14,17 20-23,28



SCHEMATIC, A/N 105202C

RECORD AMPLIFIER
7-1/2 - 15ips

Fig. 5-2-1

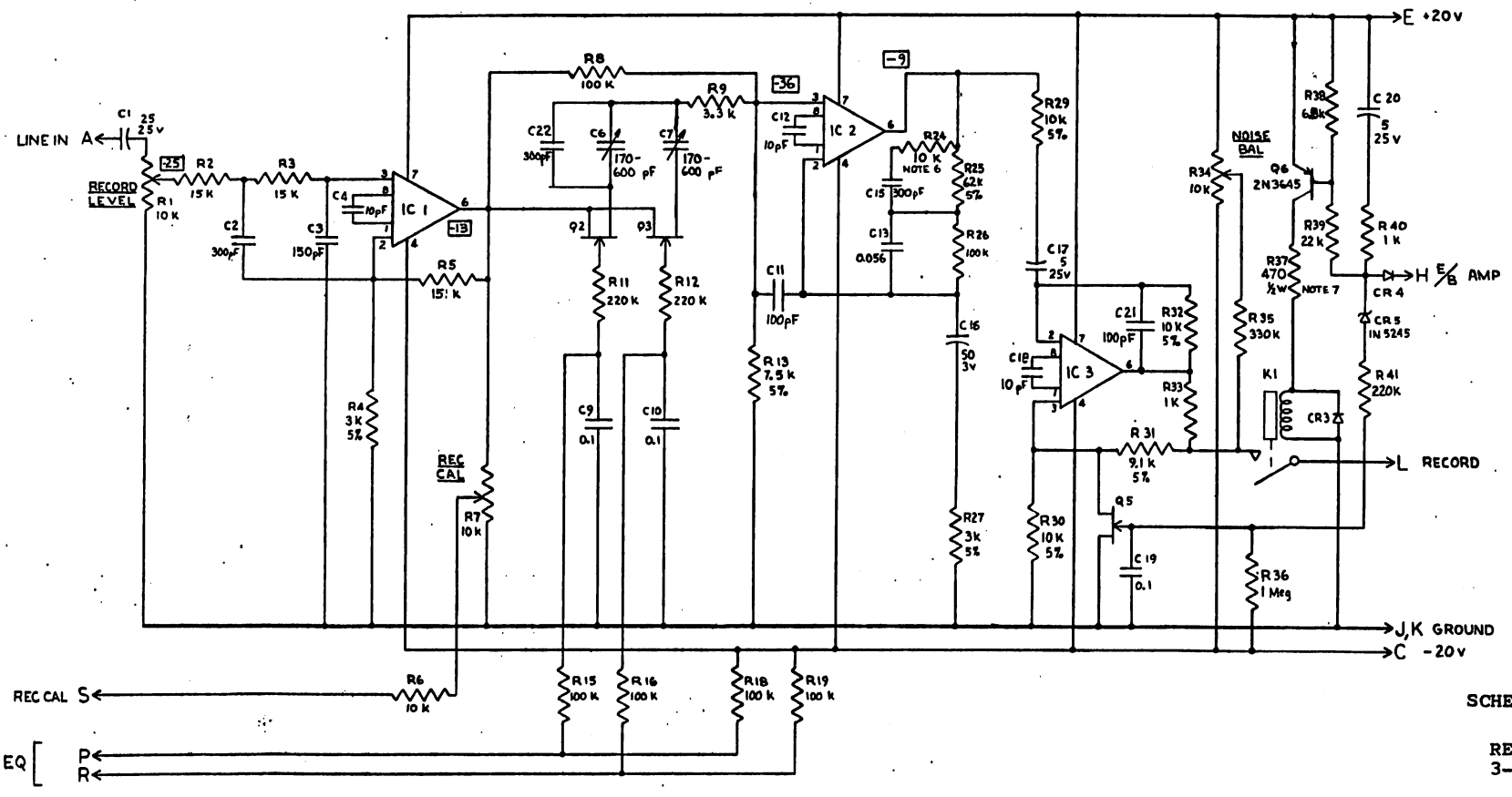
NOTES:

UNLESS OTHERWISE SPECIFIED

1. ALL FIXED RESISTORS ¼ WATT 10%, VALUE IN OHMS
2. ALL CAPACITANCE VALUES IN μF
3. ALL DIODES TYPE IN4009
4. ALL IC's TYPE 748
5. ALL FETS TYPE MPF 111
6. R24 MAY BE ALTERED FOR SMOOTHEST RESPONSE WITH OLDER HEADS
7. R 37 USED ONLY WITH 12 V K1

LAST USED REF DESIG
C 21
CR 5
IC 3
K 1
Q 6
R 41

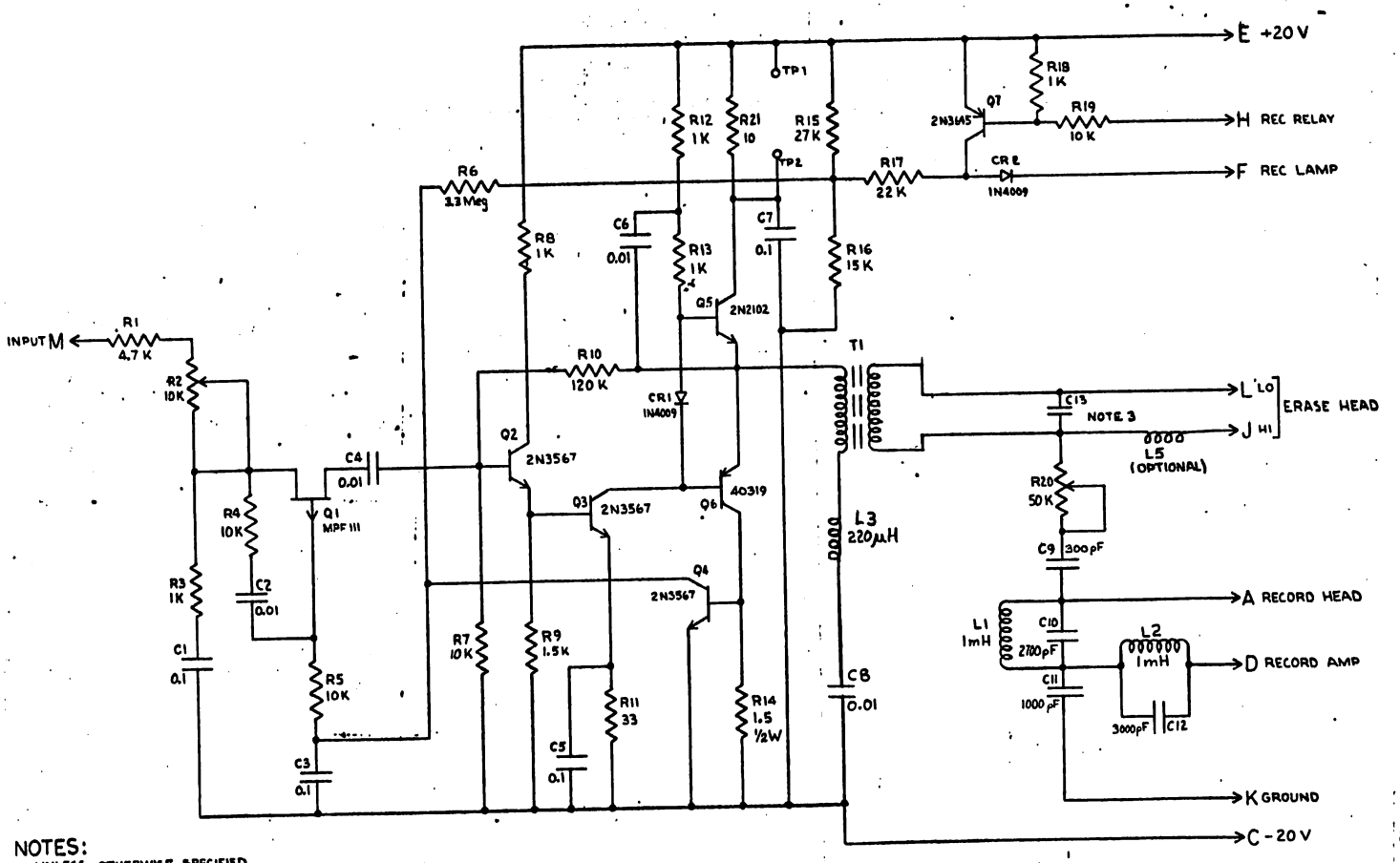
REF DESIG NOT USED
C 5,8,14
CR 1,2
Q 1,4
R10,14,17 20-23,28



SCHEMATIC, A/N 105203C

RECORD AMPLIFIER
3-3/4 - 7-1/2ips

Fig. 5-2-2



NOTES:
UNLESS OTHERWISE SPECIFIED
1. FIXED RESISTORS, ½ W, 10%, VALUE IN OHMS
2. CAPACITANCE VALUES IN μF.
3. C13 SELECTED TO MATCH ERASE HEAD

SCHEMATIC, A/N 119202 C

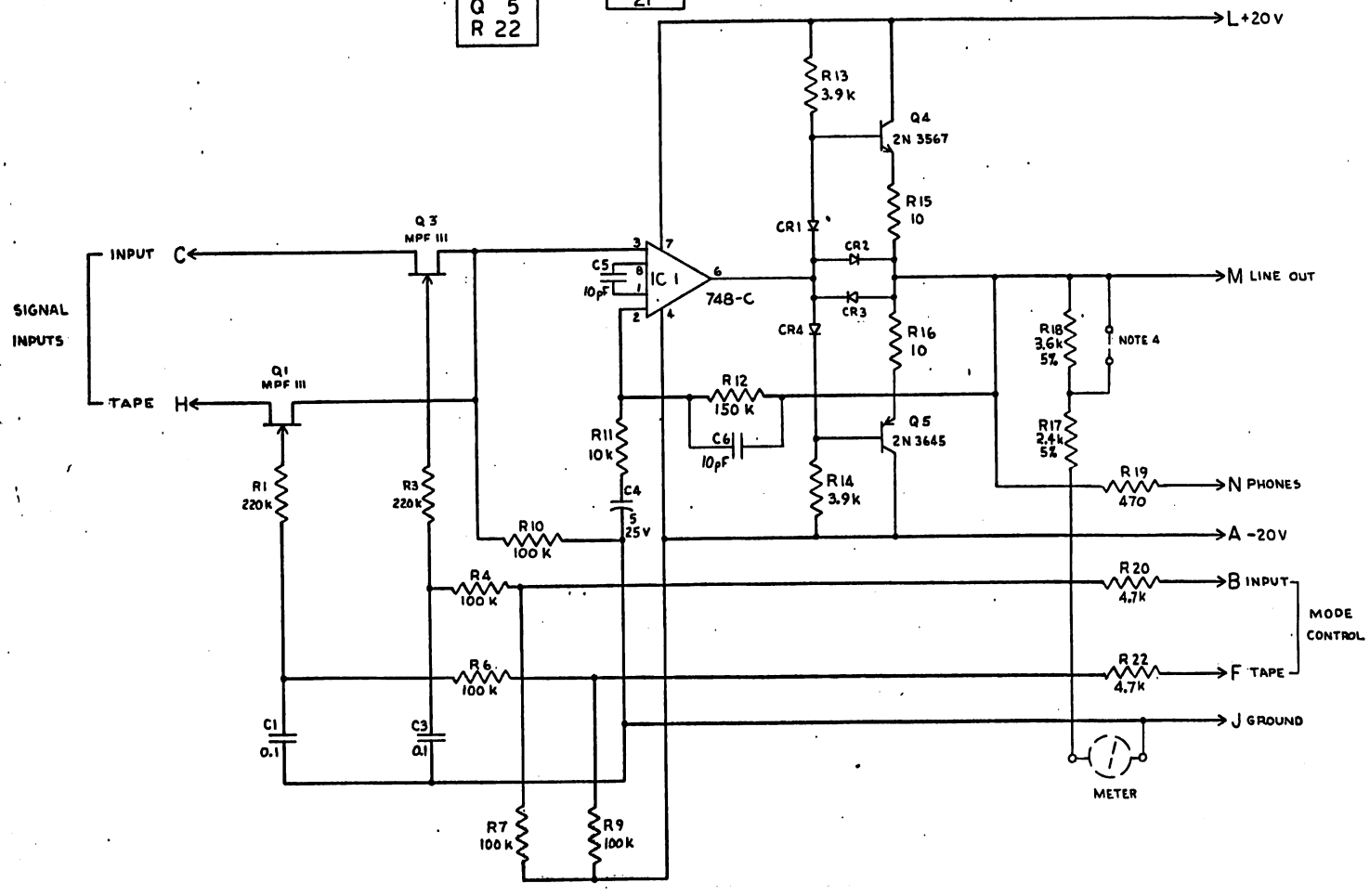
ERASE/BIAS AMPLIFIER

Fig. 5-3

NOTES:
UNLESS OTHERWISE SPECIFIED
1. RESISTORS ARE 1/4 WATT 10%, VALUE IN OHMS
2. CAPACITANCE VALUES IN μF.
3. DIODES ARE 1N4009
4. REMOVE JUMPER FOR +8dBm LINE

LAST USED REF DESIG
C 6
CR 4
IC 1
Q 5
R 22

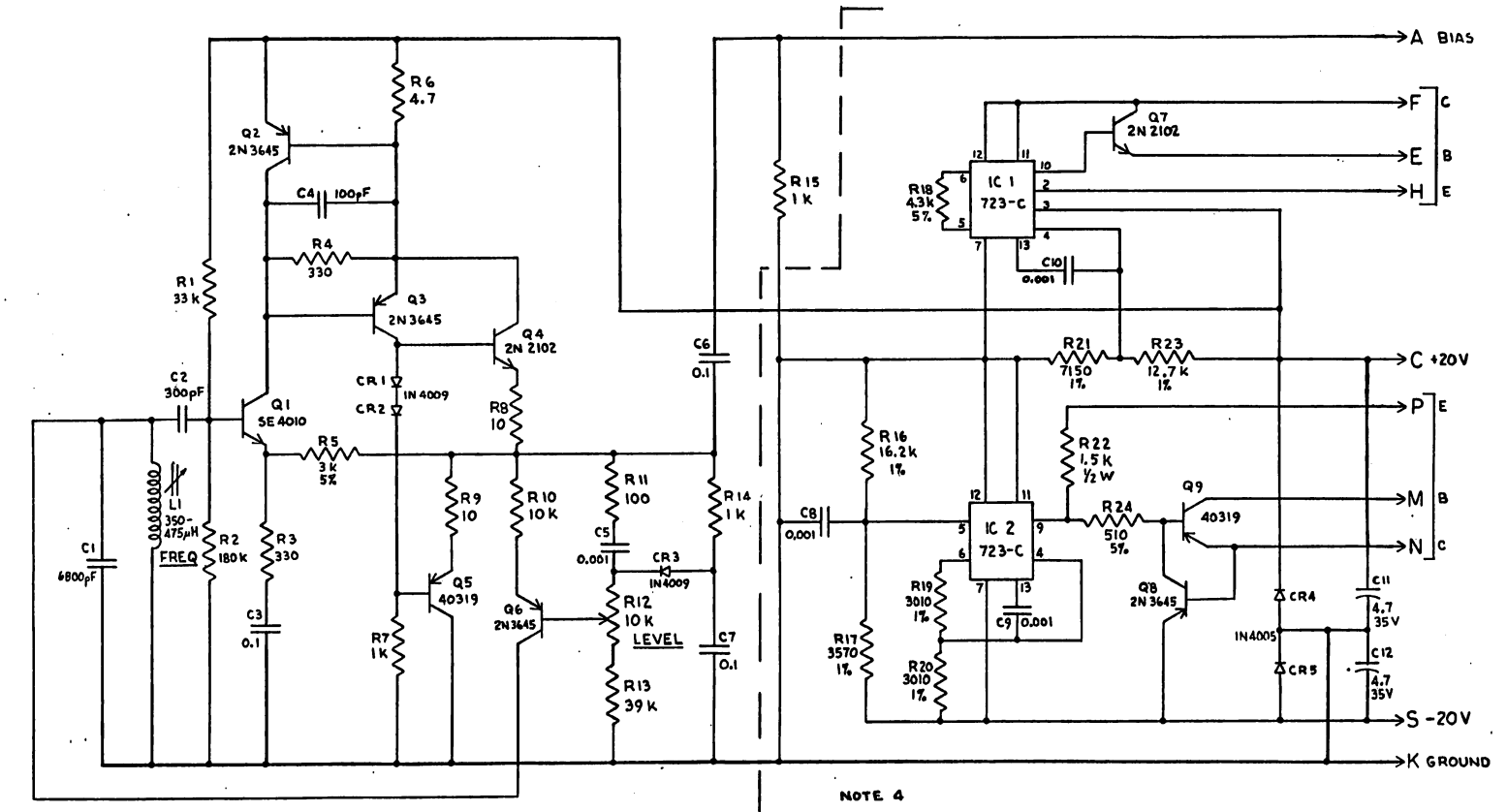
REF DESIG NOT USED
C 2
Q 2
R 2,5,8, 21



SCHEMATIC, A/N 105101A

LINE AMPLIFIER

Fig. 5-4



NOTES:

UNLESS OTHERWISE SPECIFIED

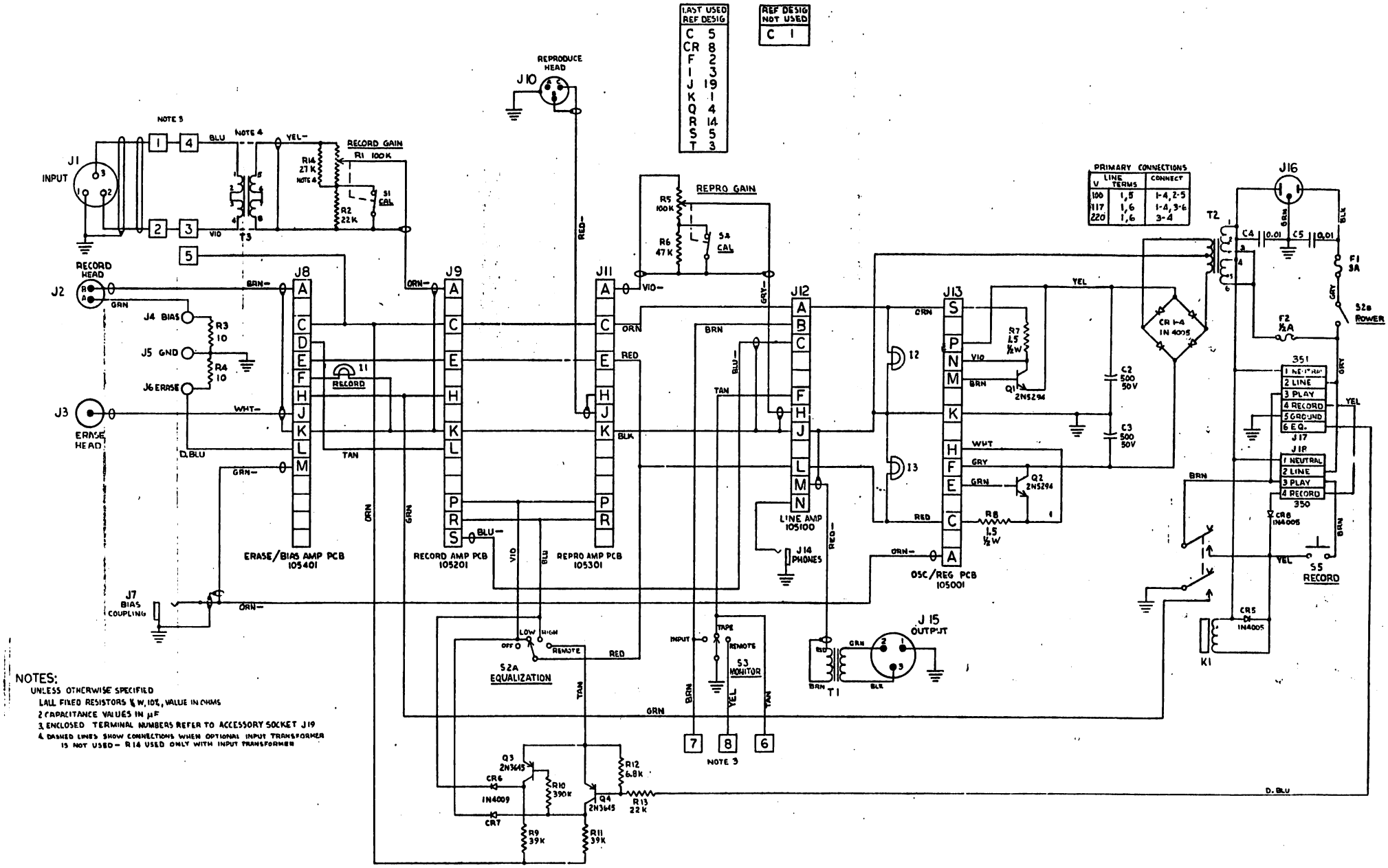
1. FIXED RESISTORS ¼ WATT 10%, VALUE IN OHMS
2. CAPACITANCE VALUES IN μF
3. USE HEAT DISSIPATORS ON Q7, Q9
4. REGULATOR CARD ASS'Y 105402 INCLUDES ONLY SECTION TO RIGHT OF DASHED LINE

LAST USED REF DESIG	
C	12
CR	5
IC	2
L	1
Q	9
R	24

SCHEMATIC, A/N 105001D /02D

OSCILLATOR / REGULATOR

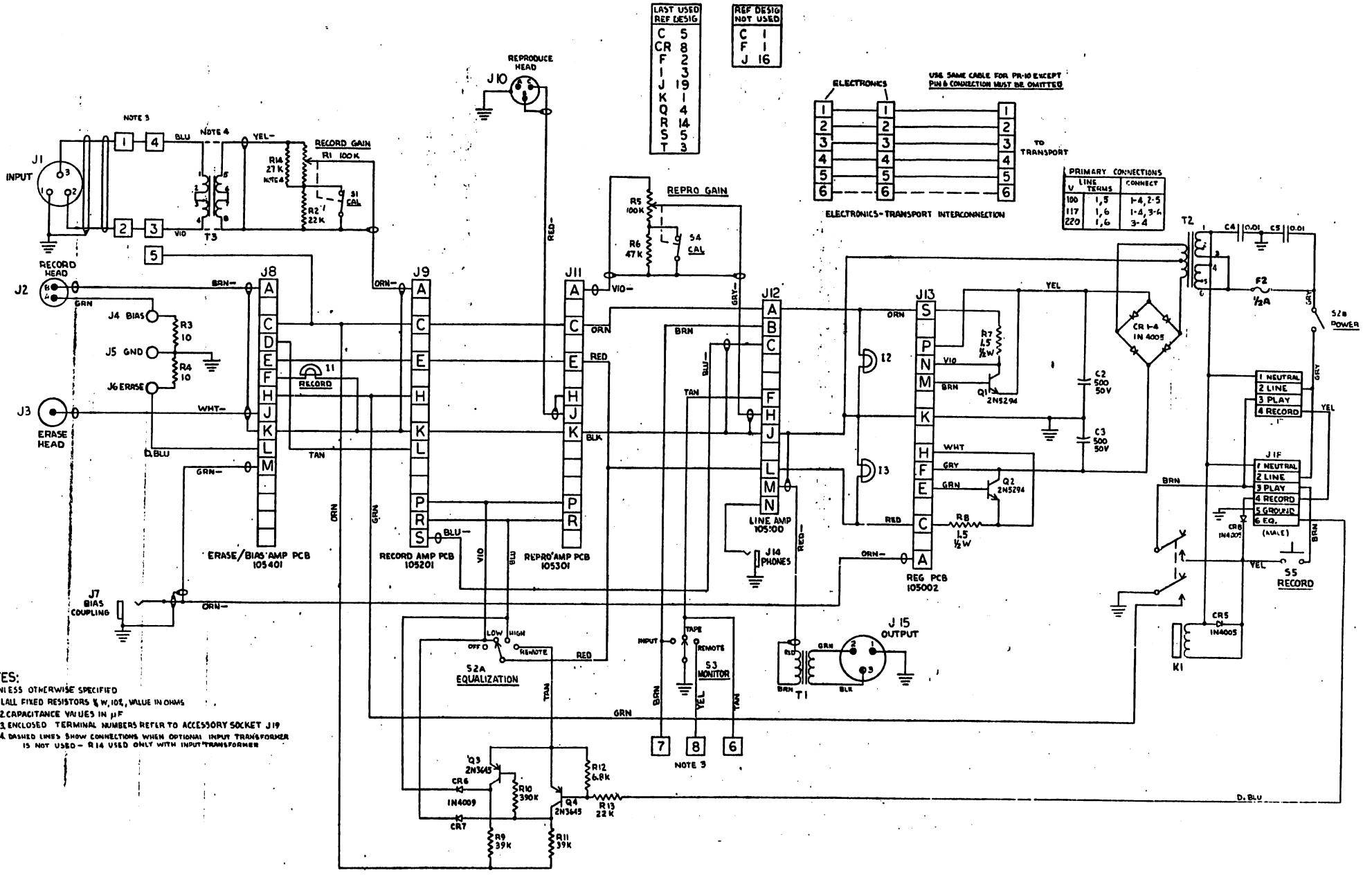
Fig. 5-5



NOTES:
UNLESS OTHERWISE SPECIFIED
1 ALL FIXED RESISTORS ½ W, 10%, VALUE IN OHMS
2 CAPACITANCE VALUES IN μF
3 ENCLOSED TERMINAL NUMBERS REFER TO ACCESSORY SOCKET J19
4 DASHED LINES SHOW CONNECTIONS WHEN OPTIONAL INPUT TRANSFORMER IS NOT USED – R14 USED ONLY WITH INPUT TRANSFORMER

SCHEMATIC, MODEL 360-B CHASSIS

MASTER (OR MONO) Fig. 5-6-1



NOTES:
UNLESS OTHERWISE SPECIFIED
1. ALL FIXED RESISTORS ½ W, 10%, VALUE IN OHMS
2. CAPACITANCE VALUES IN μF
3. ENCLOSED TERMINAL NUMBERS REFER TO ACCESSORY SOCKET J19
4. DASHED LINES SHOW CONNECTIONS WHEN OPTIONAL INPUT TRANSFORMER IS NOT USED – R14 USED ONLY WITH INPUT TRANSFORMER

SCHEMATIC, MODEL 360-B CHASSIS

SLAVE (2-TRACK) Fig. 5-6-2

** LIST OF MATERIALS **

DRAWING NO. 105001

ITEM	SCHEMATIC DESIGNATION	PART NO.	COMPONENT DESCRIPTION & MFG.'S CODE		QUAN. USED	REMARKS	
		103300 D	Oscillator & Regulator PCB		1	8.50	
		~~103401 B~~	~~Heatsink~~				
		~~2600~~	~~Heat Dissipating Fins~~	~~Wakefield 207-AB~~	~~2~~		.14
		2602	Transistor Pads	Jermyn TO5-001	8	.20	.820
		0860 ~~0830~~	0.0068 uF, 100V ~~4700~~	Sprague 225P68291 ~~472~~			
—	C 1	~~0822~~	CAPACITOR, ~~1000~~ pF, mica	~~Elmenco DM19-102J~~	1	.166	.166
—	C 2	0827	" 300 pF, mica	Elmenco DM15-301J	1	.16	.16
—	C 3,6,7	0867	" 0.1 uF, 100 V	Sprague 225P10491	3	.57	.45
—	C 4	0810	" 100 pF, mica	Elmenco DM15-101J	1	.12	.12
—	C 5,8,9,10	0850	" 0.001 uF, 100 V	Sprague 225P10291	4		
—	~~C 10~~	~~0818~~	~~" 470 pF, mica~~	~~Elmenco DM19-471J~~	~~1~~	.15	.15
—	C 11,12	1050	" 4.7 uF, 35 V tantalum	Kemet T310B475K035	2	.70	.70
—	CR 1,2,3	1100	DIODE, silicon, 1N4009	Fairchild, GE	3	.18	.18
—	CR 4,5	1125	" " 1N4005	Motorola	2	.20	.20
—	IC 1,2	1301	INTEGRATED, CIRCUIT, Type 723-C	~~Fairchild~~, Signetics	2	2.50	2.50
—	L 1	1406 ~~1402~~	INDUCTOR, Adjustable, 350-~~475~~ 430 uH	J.W. Miller ~~4394~~ 46A394 CPC	1	2.30	2.30

USED ON MODEL NO.:_____ ASSEMBLY NO.:_____

INOVONICS, INC.
CAMPBELL, CALIFORNIA

** LIST OF MATERIALS **

ITEM	SCHEMATIC DESIGNATION	PART NO.	COMPONENT DESCRIPTION & MFG.'S CODE	QUAN. USED	REMARKS
—	Q 1	1210	TRANSISTOR, SE 4010 NSC, Fairchild	1	.24 .24
—	Q 2,3,6,8	1205	" 2N3645 NSC, Fairchild	4	.60
—	Q 4,7	1201	" 2N~~3053~~ 2102 ~~Fairchild~~, RCA	2	.80
—	Q 5,9	1212	" 40319 RCA	2	1.08
—	R 1	0179	RESISTOR, ¼W, 10% 33k	1	
—	R 2	0188	" " " 180k	1	
—	R 3,4	0155	" " " 330 ohms	2	
—	R 5	0070	" " 5% 3k	1	
—	R 6	0133	" " 10% 4.7 ohms	1	
—	R 7,14,15	0161	" " " 1k	3	
—	R 8,9	0137	" " " 10 ohms	2	
—	R 10	0173	" " " 10k	1	
—	R 11	0149	" " " 100 ohms	1	
—	R 12	0510	RESISTOR, Variable, 10k Beckman Helipot 89PR10K	1	.91 .91
—	R 13	0180	" ¼W, 10%, 39k	1	
	R [illegible]	[illegible]			.65 .22

USED ON MODEL NO.:_____ ASSEMBLY NO.:_____

INOVONICS, INC.
CAMPBELL, CALIFORNIA

** LIST OF MATERIALS **

DRAWING NO.

ITEM	SCHEMATIC DESIGNATION	PART NO.	COMPONENT DESCRIPTION & MFG.'S CODE	QUAN. USED	REMARKS
/	R 16	0454	RESISTOR, Metal Film, ½W, 1% 16.2k T-1	1	
—	R 17	0451	" " " " " 3.57k T-1	1	
—	R 18	0074	" ¼W, 5%, 4.3k	1	
—	R 19,20	0450	", Metal Film, ½W, 1% 3.01k T-1	2	
—	R 21	0452	" " " " " 7.15k T-1	1	
—	R 22	0386	" ½W, 10%, 1.5k	1	
—	R 23	0453	" Metal Film, ½W, 1% 12.7k	1	
—	R 24	0053	" ¼W, 5%, 510 ohms	1	

USED ON MODEL NO.:_____ ASSEMBLY NO.:_____

INOVONICS, INC.
CAMPBELL, CALIFORNIA

** LIST OF MATERIALS **

DRAWING NO. 1050

ITEM	SCHEMATIC DESIGNATION	PART NO.	COMPONENT DESCRIPTION & MFG.'S CODE		QUAN. USED	REMARKS
		103300 C	Oscillator & Regulator PCB		1	5.50
		~~103401 B~~	~~Bracket~~			1
		2600	Heat Dissipating Fins	Wakefield 207-AB	2	.14
		2602	Transistor Pads	Jermyn TO5-001	8	.08
	C 1	0822	CAPACITOR, 1000 pF, mica	Elmenco DM19-102J	1	.21
	C 2	0827	" 300 pF, mica	Elmenco DM15-301J	1	.16
	C 3,6,7	0867	" 0.1 uF, 100 V	Sprague 225P10491	3	.10
	C 4	0810	" 100 pF, mica	Elmenco DM15-101J	1	.12
	C 5,8,9,10	0850	" 0.001 uF, 100 V	Sprague 225P10291	4	.11
	~~C 10~~	~~0818~~	~~" 470 pF, mica~~	~~Elmenco DM19-471J~~	~~1~~	.13
→	C 11,12	1050	" 4.7 uF, 35 V tantalum	Kemet T310B475K035	2	1.70
	CR 1,2,3	1100	DIODE, silicon, 1N4009	Fairchild, GE	3	.15
	CR 4,5	1125	" " 1N4005	Motorola	2	1.20
	IC 1,2	1301	INTEGRATED, CIRCUIT, Type 723-C	Fairchild, Signetics	2	2.60
	L 1	1406	INDUCTOR, Adjustable, 350-430 uH	J.W. Miller 46A394CPC ~~4514~~	1	2.30

USED ON MODEL NO.: 900 ASSEMBLY NO.: 105000

INOVONICS, INC.
CAMPBELL, CALIFORNIA

** LIST OF MATERIALS **

DRAWING NO. 1050

ITEM	SCHEMATIC DESIGNATION	PART NO.	COMPONENT DESCRIPTION & MFG.'S CODE	QUAN. USED	REMARKS
—	Q 1	1210	TRANSISTOR, SE 4010 NSC, Fairchild	1	.24
—	Q 2,3,6,8	1205	" 2N3645 NSC, Fairchild	4	.88
	Q 4,7	~~1201~~ 1200	" ~~2N3053~~ 2102 Fairchild, RCA	2	.50
	Q 5,9	1212	" 40319 RCA	~~4~~ 2	1.40
	R 1	0179	RESISTOR, ¼W, 10% 33k	1	.06
	R 2	0188	" " " 180k	1	.06
	R 3,4	0155	" " " 330 ohms	2	.12
	R 5	0070	" " 5% 3k	1	.10
	R 6	0133	" " 10% 4.7 ohms	1	.06
	R 7,14,15	0161	" " " 1k	3	.18
	R 8,9	0137	" " " 10 ohms	2	.12
	R 10	0173	" " " 10k	1	.06
	R 11	0149	" " " 100 ohms	1	.06
	R 12	0510	RESISTOR, Variable, 10k Beckman Helipot 89PR10K	1	.95
	R 13	0180	" ¼W, 10%, 39k	1	.06
	R 14	0154			

USED ON MODEL NO.: _____ ASSEMBLY NO.: _____

INOVONICS, INC.
CAMPBELL, CALIFORNIA

** LIST OF MATERIALS **

DRAWING NO. 1050

ITEM	SCHEMATIC DESIGNATION	PART NO.	COMPONENT DESCRIPTION & MFG.'S CODE	QUAN. USED	REMARKS
	R 16	0454	RESISTOR, Metal Film, ½W, 1% 16.2k T-1	1	.20
	R 17	0451	" " " " " 3.57k T-1	1	.20
	R 18	0074	" ¼W, 5%, 4.3k	1	.10
	R 19,20	0450	", Metal Film, ½W, 1% 3.01k T-1	2	.40
	R 21	0452	" " " " " 7.15k T-1	1	.20
	R 22	0386	" ½W, 10%, 1.5k	1	.06
	R 23	0453	" Metal Film, ½W, 1% 12.7k	1	.20
	R 24	0053	" ¼W, 5%, 510 ohms	1	.10
			Total/board		22.63

USED ON MODEL NO.:_____ ASSEMBLY NO.:_____

INOVONICS, INC.
CAMPBELL, CALIFORNIA

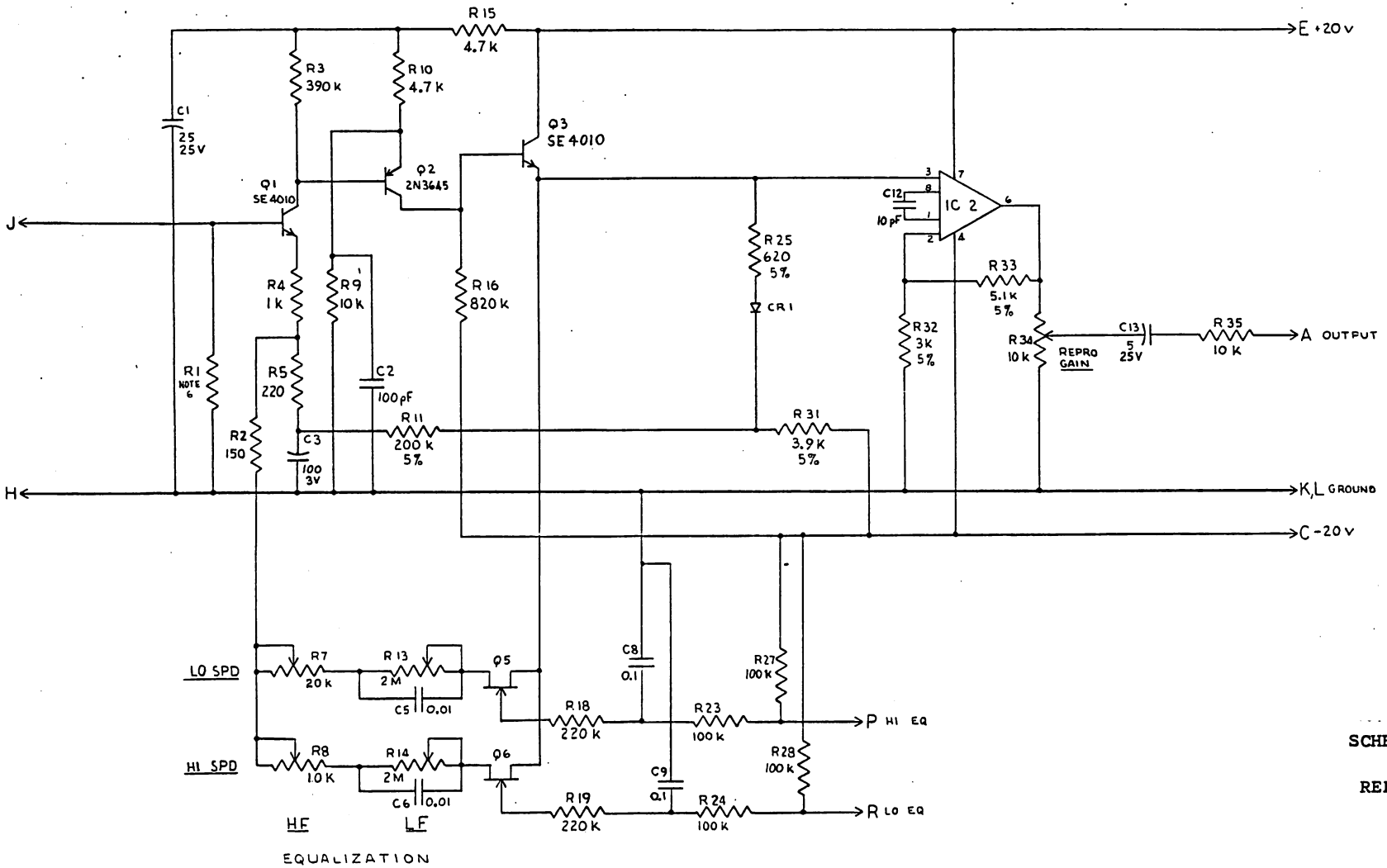
NOTES:

UNLESS OTHERWISE SPECIFIED

1. ALL FIXED RESISTORS 1/4 WATT 10%, VALUE IN OHMS
2. ALL CAPACITANCE VALUES IN μF
3. ALL DIODES TYPE IN4009
4. ALL IC's TYPE 748
5. ALL FET's TYPE MPF 111
6. SELECTED FOR BEST H.F. RESPONSE

LAST USED REF DESIG
C 13
CR 1
IC 2
Q 6
R 35

REF DESIG. NOT USED
C 4,7,10,11
IC 1
Q 4
R 6,12,17,30 20-22,26,29



SCHEMATIC, A/N 105301B

REPRODUCE AMPLIFIER

Fig. 5-1

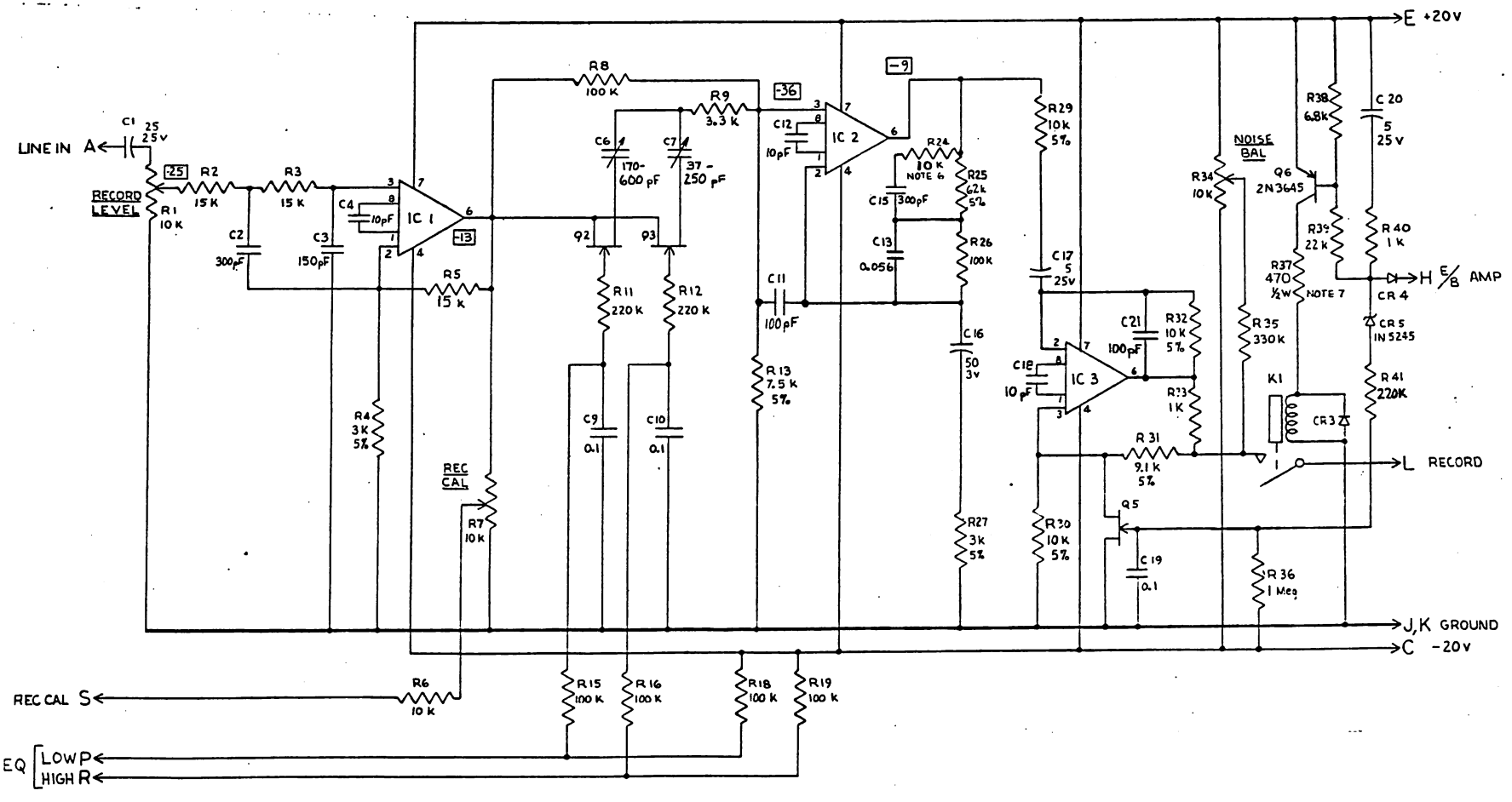
NOTES:

UNLESS OTHERWISE SPECIFIED

1. ALL FIXED RESISTORS ¼ WATT 10%, VALUE IN OHMS
2. ALL CAPACITANCE VALUES IN μF
3. ALL DIODES TYPE IN4009
4. ALL IC's TYPE 748
5. ALL FET's TYPE MPF 111
6. R24 MAY BE DELETED FOR SMOOTHEST RESPONSE WITH OLDER HEADS
7. R 37 USED ONLY WITH 12 V K1

LAST USED REF DESIG
C 20
CR 5
IC 3
K 1
Q 6
R 41

REF DESIG NOT USED
C 5,8,14
CR 1,2
Q 1,4
R10,14,17 20-23,28



SCHEMATIC, A/N 105202C

RECORD AMPLIFIER
7-1/2 - 15ips

Fig. 5-2-1

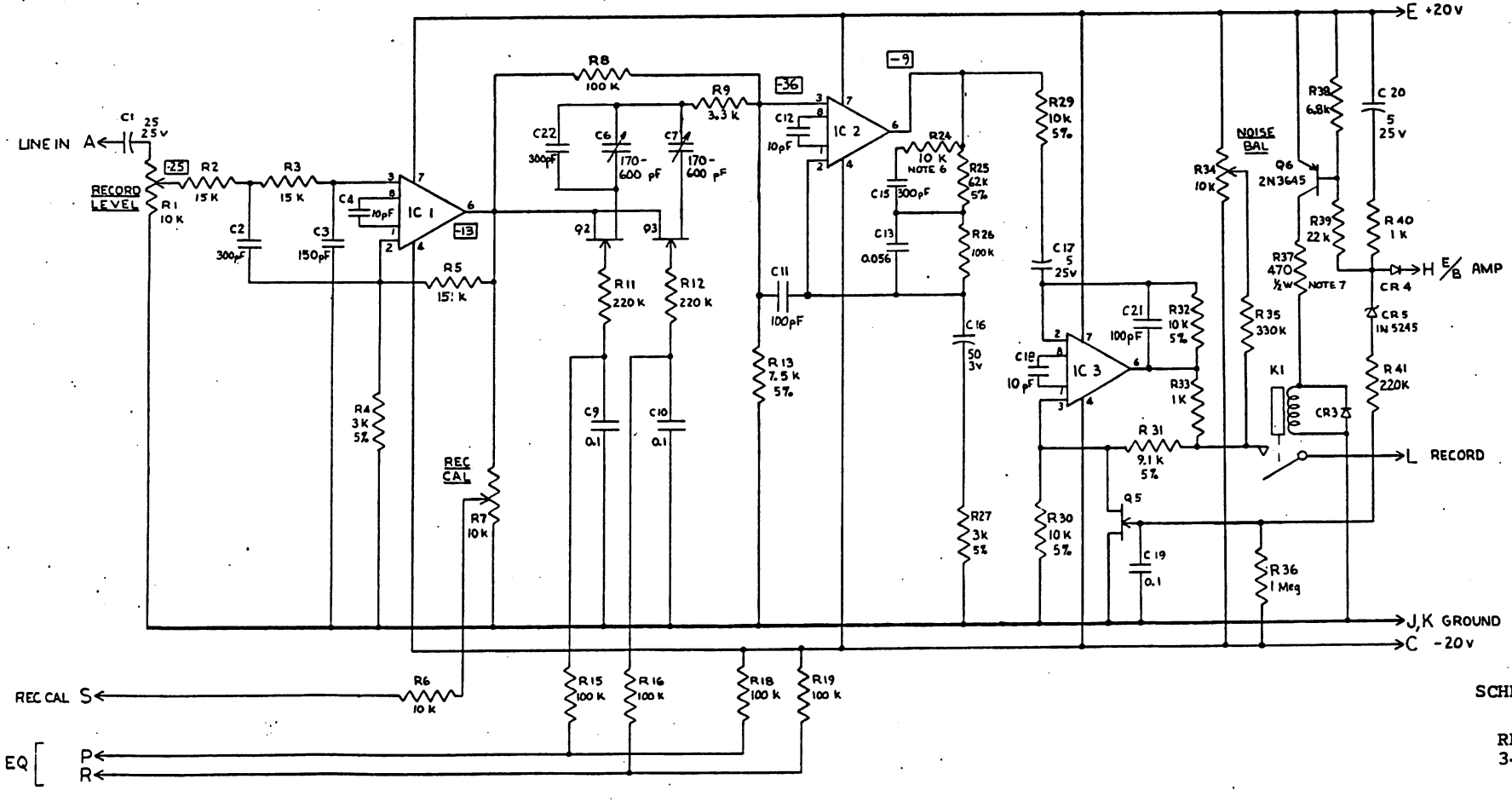
NOTES:

UNLESS OTHERWISE SPECIFIED

1. ALL FIXED RESISTORS ¼ WATT 10%, VALUE IN OHMS
2. ALL CAPACITANCE VALUES IN μF
3. ALL DIODES TYPE IN4009
4. ALL IC's TYPE 748
5. ALL FET'S TYPE MPF 111
6. R24 MAY BE ALTERED FOR SMOOTHEST RESPONSE WITH OLDER HEADS
7. R 37 USED ONLY WITH 12 V K1

LAST USED REF DESIG
C 21
CR 5
IC 3
K 1
Q 6
R 41

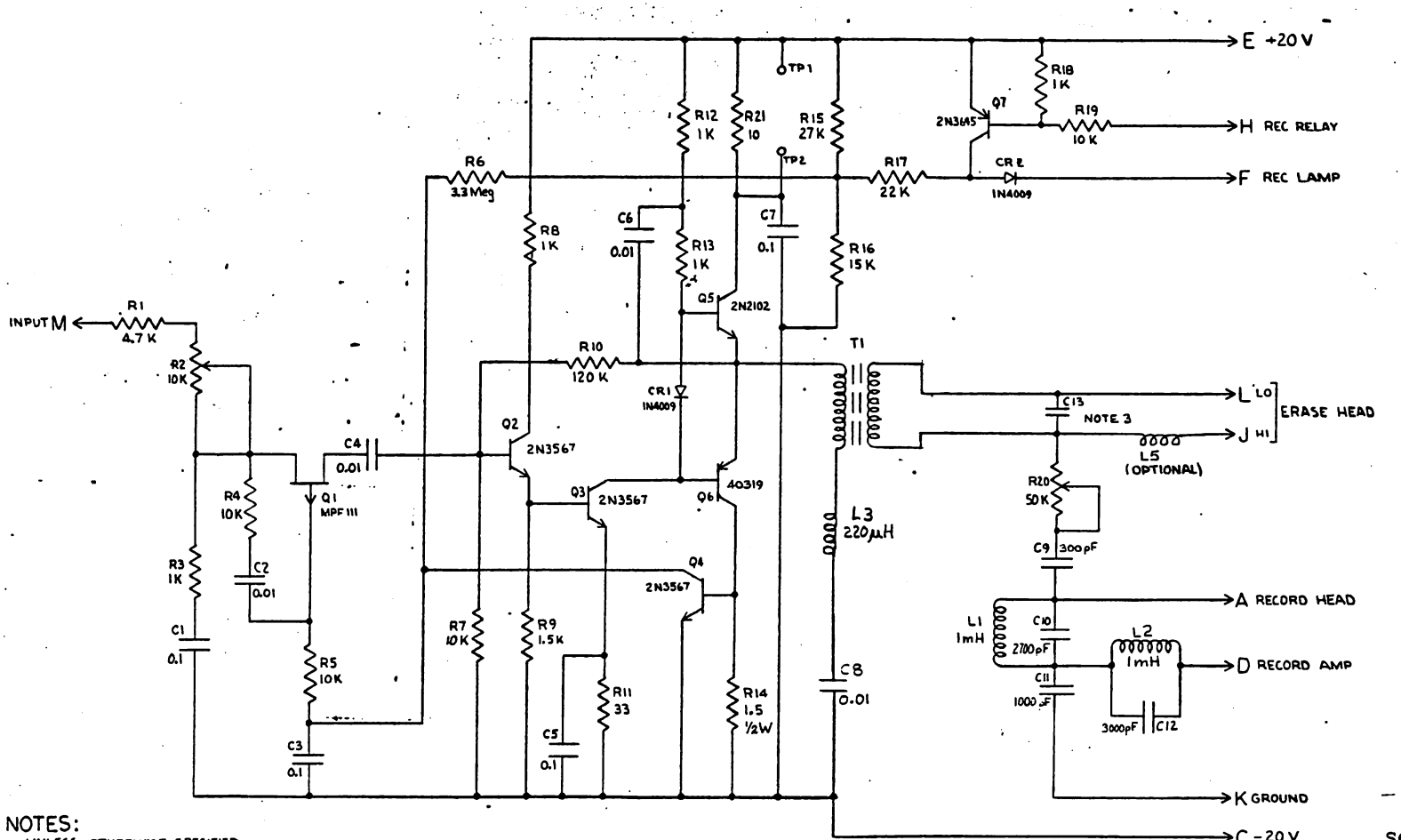
REF DESIG NOT USED
C 5,8,14
CR 1,2
Q 1,4
R10,14,17 20-23,28



SCHEMATIC, A/N 105203C

RECORD AMPLIFIER
3-3/4 - 7-1/2ips

Fig. 5-2-2



NOTES:

UNLESS OTHERWISE SPECIFIED

1. FIXED RESISTORS, ¼ W, 10%, VALUE IN OHMS
2. CAPACITANCE VALUES IN µF.
3. C13 SELECTED TO MATCH ERASE HEAD

SCHEMATIC, A/N 119202 C

ERASE/BIAS AMPLIFIER

Fig. 5-3

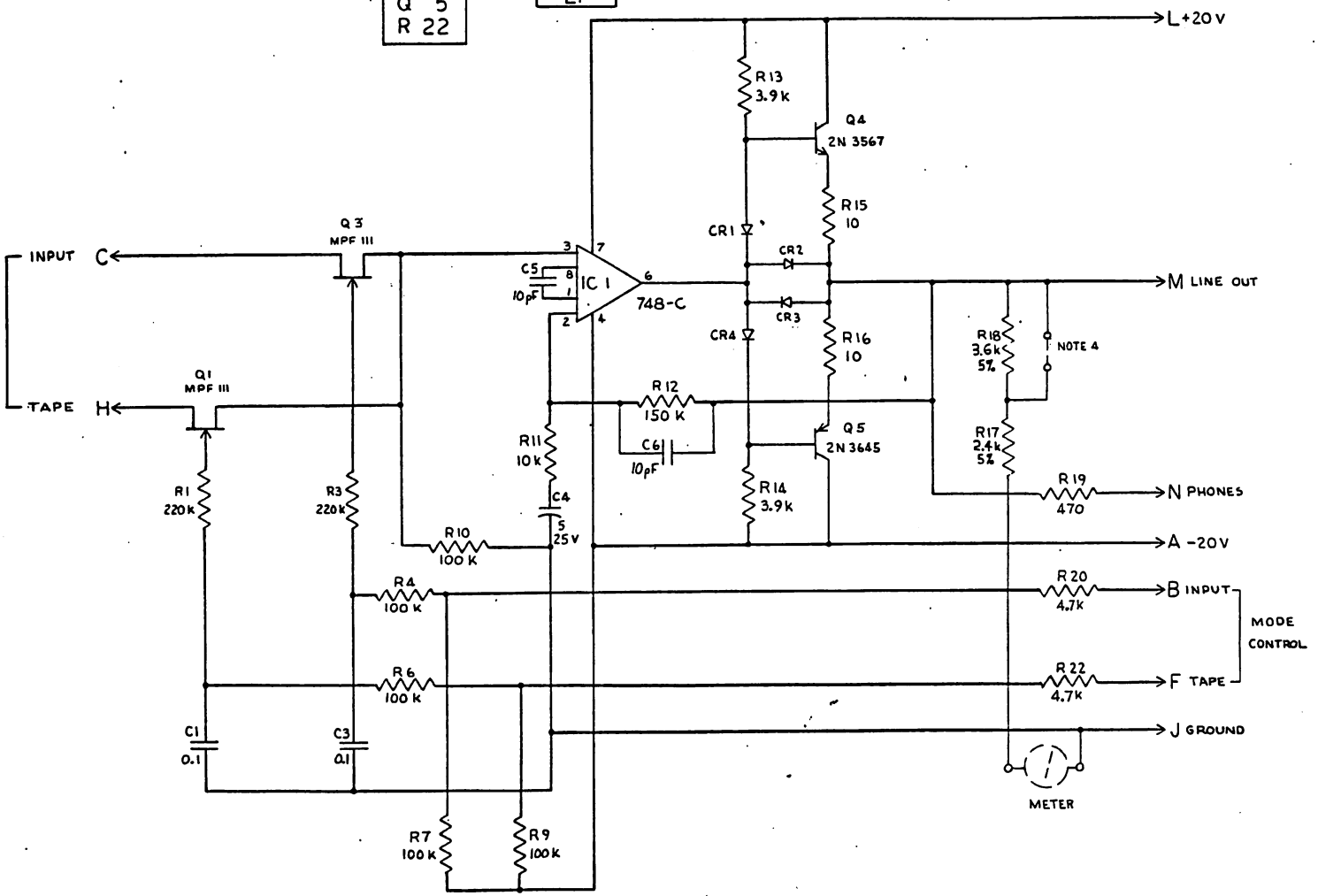
NOTES:

UNLESS OTHERWISE SPECIFIED

1. RESISTORS ARE 1/4 WATT 10%, VALUE IN OHMS
2. CAPACITANCE VALUES IN μF.
3. DIODES ARE 1N4009
4. REMOVE JUMPER FOR +8dBm LINE

LAST USED REF DESIG
C 6
CR 4
IC 1
Q 5
R 22

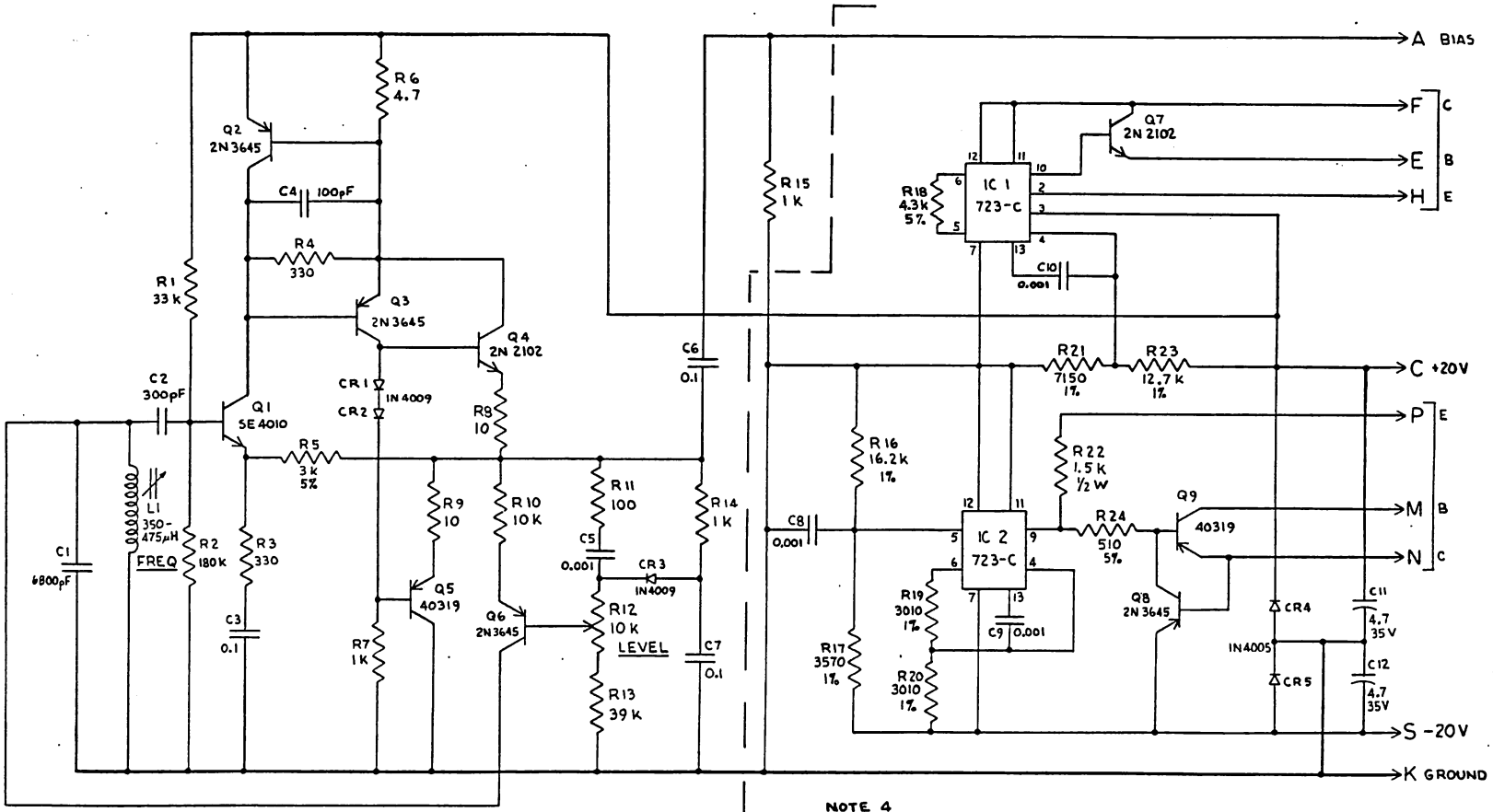
REF DESIG NOT USED
C 2
Q 2
R 2,5,8, 21



SCHEMATIC, A/N 105101A

LINE AMPLIFIER

Fig. 5-4



NOTES:

UNLESS OTHERWISE SPECIFIED

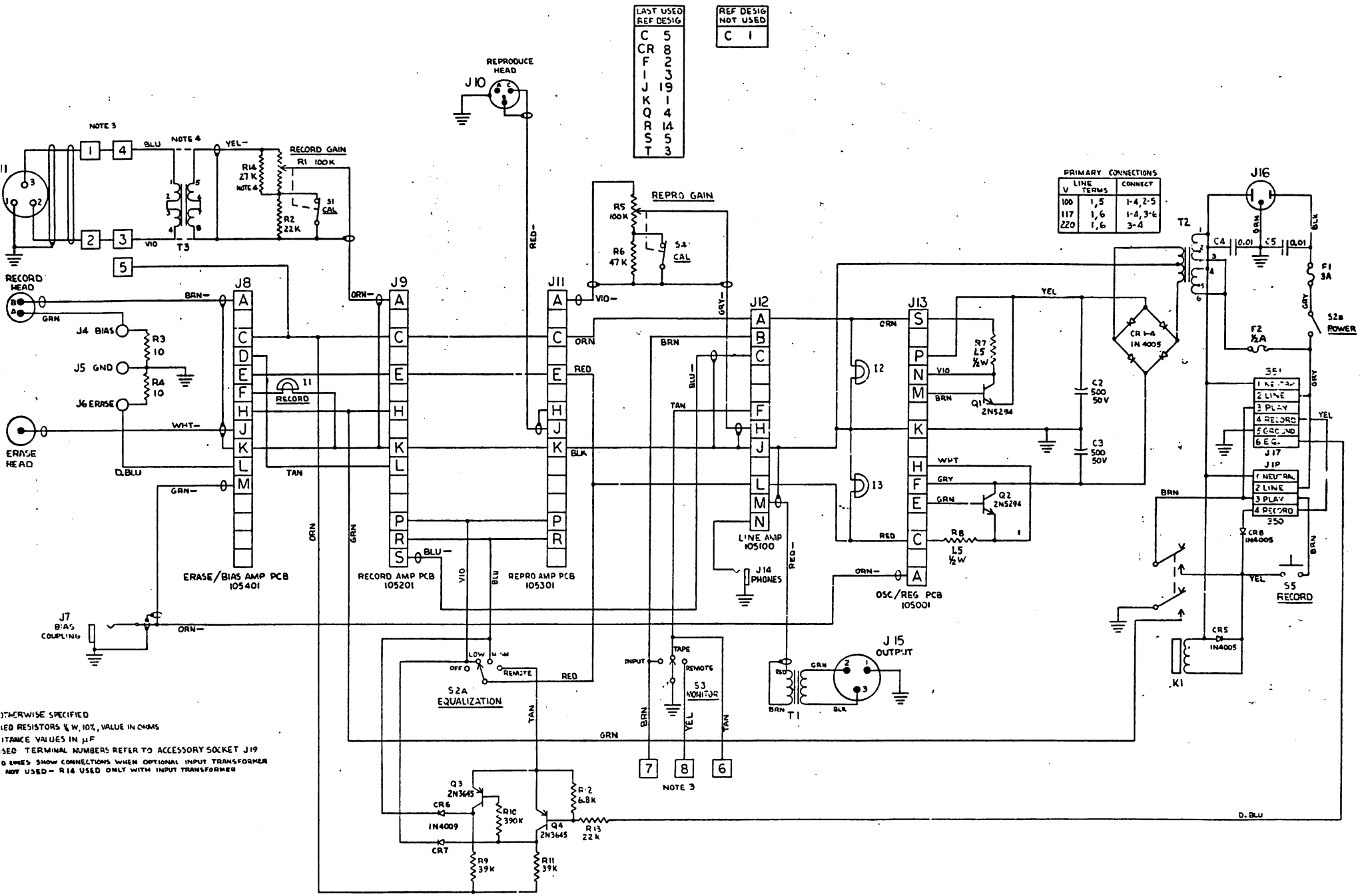
1. FIXED RESISTORS ¼ WATT 10%, VALUE IN OHMS
2. CAPACITANCE VALUES IN μF
3. USE HEAT DISSIPATORS ON Q7, Q9
4. REGULATOR CARD ASS'Y 105402 INCLUDES ONLY SECTION TO RIGHT OF DASHED LINE

LAST USED REF DESIG
C 12
CR 5
IC 2
L 1
Q 9
R 24

SCHEMATIC, A/N 105001D /02D

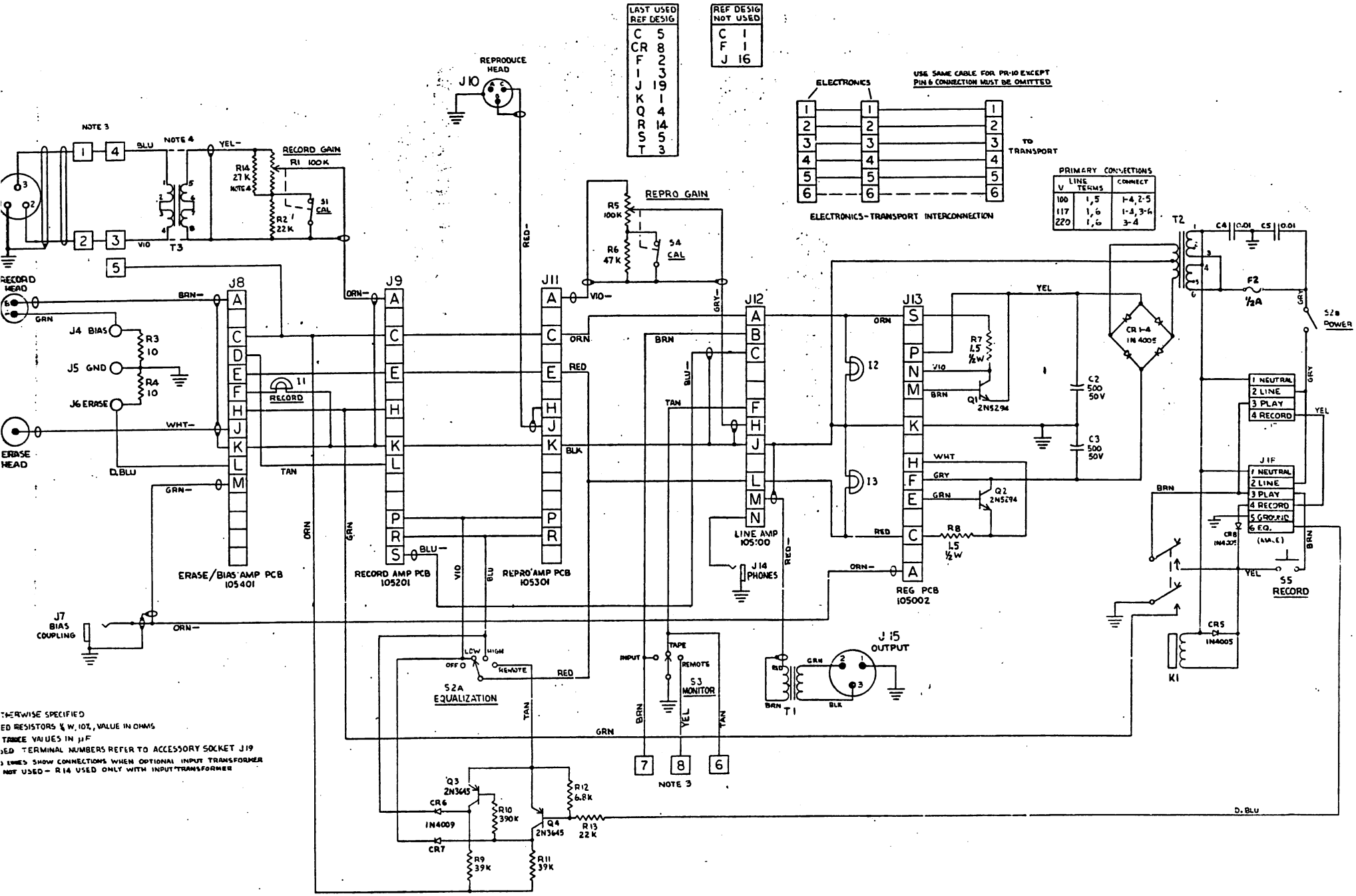
OSCILLATOR / REGULATOR

Fig. 5-5



SCHEMATIC, MODEL 360-B CHASSIS

MASTER (OR MONO) Fig. 5-6-1



SCHEMATIC, MODEL 360-B CHASSIS

SLAVE (2-TRACK) Fig. 5-6-2

360 CARD CARRIER ASSEMBLY

A. Mechanical Assembly

1. Install two 2902 card guides in each shield. Guides must be cut off immediatetely behind rear mounting button.
2. Install 1706 card keys between A & B of 1/3 of 1703 connectors.
   " " " " " D & E " " " " "
   " " " " " M & N " " " " "
3. Place 4.8" strip of 1/32" tape between mounting buttons of 1/3 of the 2902 card guides.
4. Install a pair of guides prepared in step #3 in the lower set of holes in one 108200 and one 108201 side bracket (bottom flanges out).
5. Use 4-40 x 3/16 nuts between guide and bracket to secure card connector prepared with key in M-N position, with 4-40 x 3/8" screws (terminal A to left as viewed from front). Do not tighten.
6. Install shield subassembly in middle set of holes in side brackets.
7. Install socket with key in D-E position in center as in Step #5.
8. Repeat Step #6 in top set of holes.
9. Install socket with key in A-B position in top bracket holes as in Step #5.
10. Insert a set of cards, lay assembly on a flat surface, and tighten screws.

B. Preliminary Wiring

1. Run #22 tinned buss wire through all pins C and solder top and center connectors only; keep wire at bottom of contact slot.
2. Repeat for pins E, K, P & R, soldering at top connector only.
3. Run buss wire through pins H of middle and bottom connectors; solder bottom contact only.
4. Run a tan wire from pin D of bottom connector to pin L of center connector.

360 CHASSIS PAN SUBASSEMBLY

1. Install 109000 Output Transformer with two 6-32 x ¼" screws, nuts and lock washers; place 1727 terminal strip under screw closest to edge of chassis

2. Install card carrier assembly using four 6-32 x ¼" screws, nuts, and lockwashers.

3. Install 1902 relay with 1125 Diode across coil, terminals toward center of chassis, with one 6-32 x 3/8" screw.

4. Take two 1213 transistors and bend leads 90° away from their mounting surfaces, ¼" from body of each transistor, supporting leads between bend and transistor with pliers. Press 2604 shoulder washer into mounting hole of each transistor(from top). Using thermal compound on both sides of a 2605 mica washer under the mounting surface of each transistor, install transistors using 4-40 x ¼' screws and nutss (leads toward center of chassis flange).

5. Using four H.H.Smith 2371 spacers and 4-40 x 3/16" screws, mount 105001 Osc/Reg board on side of chassis near transistors. Install 1703 card connector, with 1.5Ω resistors between pins C & H and S & N.