INSTRUCTION MANUAL

MODEL 376

TAPE REPRODUCE AMPLIFIER

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INOVONICS
INCORPORATED

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I. GENERAL INFORMATION

The Inovonics 376 is a self-contained, dual-channel magnetic tape reproduce amplifier for professional applications demanding uncompromising performance and reliability.

Features of the 376 include:

Accommodates virtually any tape or film reproduce head. -01 option can be strapped for either Hi-Z or Lo-Z head windings.

Low noise design utilizes an optimum combination of IC and discrete circuitry for lowest residual electronics noise.

3-speed equalization has wide adjustment range for any combination of NAB and IEC recording characteristics, 3-3/4 to 30 ips. Solid state EQ switching is remotable for control by transport speed switch.

Phase Compensation Adjustment can be trimmed to correct for errors in the recording process which ordinarily degrade multi-generation tape copies.

Multi-turn trim controls and fully regulated power supply assure stability of settings and drift-free operation.

INOVONICS 376 SPECIFICATIONS

NOTE: Performance will obviously depend on heads used. Specifications were derived utilizing a Nortronics 9213, 400mH 2-track reproduce head, and represent a system with 70-80 mil tracks as in 2-, 4-, 8- or 16-track formats.

Frequency Response (in dB)

30 ips	±2dB,	60-22k
15 ips	±2dB,	30-22k
7-1/2 ips	±2dB,	20-16k
3-3/4 ips	±3dB,	20-12k

Signal-to-Noise Ratio (STANDBY in dB)

	u'wtd.	wtd.
30 ips	-74	-83
15 ips	-70	-81
7-1/2 ips	-70	-81
3-3/4 ips	-69	-80

(referenced to a "peak" record level 6dB above 200nW/m, or approximately 3dB below 3% THD point of 3M 206 tape)

Amplifier Distortion

0.1% THD at +4 or +8dBm output
0.3% THD at +23dBm output
(Clipping level +25dBm)

Output

Transformer isolated, feeds 600 ohm line, balanced or unbalanced, terminated or not, at +4 or +8dBm for zero-VU.

Recommended Reproduce Head Inductances

	RANGE	OPTIMUM
-00 version	200mH - 1H	400mH
-01 "	3 - 6mH	4mH
-01 "	200mH - 1H	400mH

Panel Controls

Pushbutton selection of POWER and HIGH, INTER. or LOW equalization. Hidden slide switch for Phase Comp. enable/disable.

Trim Controls

For each of two channels: GAIN, PHASE COMP., HF and LF EQUAL for each of 3 speeds.

Power Requirement

105-130VAC (230V available), 50/60Hz; .2A (plus transport, if applicable)

Size and Weight

3-1/2" x 19" x 10"; 16 lbs.

II. INSTALLATION

Upon receipt of the equipment, inspect at once for shipping damage. Should any such damage be observed, notify the carrier at once; if not, proceed as outlined below. It is suggested that the shipping carton and materials be retained should future re-shipment become necessary.

Mounting

The Inovonics 376 is packaged to mount in a standard 19-inch equipment rack or overbridge, requiring only 3-1/2 inches of panel space for each two channel unit.

Connection

The head connectors are the standard 3-pin "MS" style commonly encountered in professional recorders for reproduce head connection.

The Line Output jacks are 3-pin "XL" males. A two circuit phone jack on the front panel accepts a stereo headset.

A captive cord connects with primary AC power, and a 6-pin "Jones" connector provides power to the tape transport, if required.

Two rear panel multi-pin connectors facilitate the interconnection of one or more units with spare transport SPEED switch contacts for automatic equalization switching.

III. OPERATION AND CALIBRATION

Power Switching

Power to the 376, and to the tape transport if plugged into the 376, is switched by the front panel, alternate-action POWER switch. A "power on" condition is indicated by illumination of the POWER switch, the selected EQUALIZATION button and meter lights.

The EQUALIZATION buttons select a reproduce equalization curve appropriate to the transport speed. Three independent sets of equalizers are provided, although most transports are only dual speed units. In these cases, the third position may be used for a European or other non-standard curve. In the event of use with a transport providing an equalization-switching pole on the speed change switch, the equalization can be transferred to change automatically (if the transport and 376 are appropriately wired and interconnected) by depressing an EQUALIZATION button slightly so that all three buttons are "out." In the case of either manual or automatic equalization selection, the appropriate button lights to indicate the selected characteristic.

Level and Equalization Adjustments

Trim controls for the reproduce amplifiers are located on the circuit board behind the adjustment cover panel. All controls are identified as to function by silkscreened designations on the rear of the cover panel.

Each of the two channels has separate and identical controls for level adjustment, and equalization for each of three speeds. The three equalizers differ only in that the LOW position has extended range for the 3-3/4 ips curve. All three positions may be used, nevertheless, for 7-1/2, 15 or 30 ips.

Calibration of the 376 is as follows:

1. Heads should be thoroughly demagnetized and a Standard Tape threaded on the transport.

2. While reproducing the highest frequency on the Standard Tape, adjust reproduce head azimuth for maximum output. If two slightly different azimuth peaks are noted for the two channels, a "split difference" compromize adjustment can be made. The alternative "phaze difference" azimuth adjustment method yields a more accurate setting, but requires use of an oscilloscope. If the "phase difference" method is employed, make sure that the PHASE COMP

enable/disable switch is OFF.

3. 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 noted at highest frequencies. R1 (and R51) on the PCB is provided to damp this resonance. To determine whether its value is correct for the head used, set the HF equalization control so that playback near 5kHz is flat with respect to the reference frequency on the Standard Tape. Note response at the highest frequencies, and raise the value of R1 to increase, or lower to decrease this value. It is suggested that this R1 (R51) value determination test be performed at all speeds for which the 376 is to be used, so that if more than one value proves optimum a compromise value can be chosen.

4. Set the HF and LF controls for flattest response at each of the speeds employed. If the Standard Tape track width is not the same as the track width of the reproduce head, "fringing" effects will cause erroneous low frequency response readings. This is a common problem when a full track Standard Tape is reproduced with a 2- or 4-track head. In these cases, a "fudge factor" of about 2 or 3dB at 50Hz can be used, and requires that response at 50Hz be adjusted 2 or 3dB above the level of the reference frequency. In some cases, a more accurate "fudge chart" is provided with the Standard Tape.

5. The reproduce LEVEL control is adjusted for "0-VU" at the Operating Level tone on the Standard Tape. This setting will be the same for all equalization characteristics as long as the Operating Level remains constant.

Phase Compensation Adjustment

The reproduce Phase Compensation circuit corrects for phase distortion errors in the recording process which can degrade the quality of multi-generation tape copies. The Phase Compensation circuit is adjustable, but as an adjustment is optimum at only one speed, a PHASE COMP switch permits disabling the circuit at speeds other than the one for which it is adjusted.

Proper adjustment of the PHASE COMP controls requires a tape prerecorded with a 3kHz squarewave at a VU-indicated level 6dB or more below Operating Level. When the tape is played, the PHASE COMP controls are adjusted for a squarest-looking waveform as monitored with an oscilloscope connected to the 376 output.

Since the PHASE COMP control shifts the phase of high frequency signals relative to low frequencies, the circuits must be adjusted identically

in both channels to avoid high frequency cancellations in L + R derived monaural mixes. To insure identical adjustment, one PHASE COMP control can be re-trimmed slightly while the oscilloscope monitors both channels on its X and Y axes.

Line Termination

The output impedance of the 376 is very low, as evidenced by less than 1dB shift in output level when the unit is terminated in 600 ohms from an unloaded condition. Nevertheless, should the 376 output be presented with an unusually high load capacitance, as might be encountered when feeding long cables, response at high frequencies may be accentuated. For this reason a rear panel Line Termination switch is provided, and should be kept in the TERM position when the 376 output is connected to bridging inputs or otherwise not terminated by the output load.

IV. CIRCUIT DESCRIPTIONS

Circuit Notes

The signal circuitry for both channels is contained on a single plug-in board accessable from the front of the unit. All circuit adjustments appear along the front edge of this board, and are identified both as to function and component reference designation on the reverse of the removable adjustment cover.

Circuitry for the two channels is identical, and layout of the schematic diagram makes comparison easy. Thus, only circuitry for Channel A will be described.

The regulated Power Supply utilizes "3-terminal" integrated circuit regulators and very few additional components. This circuit will not be described in detail, as there is really nothing to describe!

Input Preamplifier

A series of straps on the circuit board permits routing the signal from the reproduce head either directly to the input stage or to the optional head input transformer. The transformer option must be included if low inductance (3-5mH) heads are to be used. Resistor R1 is selected to dampen head resonance and yield smoothest playback response. The selection procedure is described on Pg. 8.

Transistors Q1 and 2 form a complementary feedback-pair input stage, Q3 serving primarily as an emitter-follower buffer. DC feedback is maintained through R19 and 11, bypassed at audio frequencies by C2. AC feedback is routed through an appropriate equalization network by FET switches Q4, 5 or 6. A ground from the selected EQUALIZATION button turns the appropriate FET "on," while the others are held "off" by a negative DC voltage through the lamp filaments of the other buttons.

A secondary function of Q3 is to provide a phase-inverted reproduce signal (at the collector) for the reproduce Phase Compensation circuit. This signal, coupled through C7, interacts with the in-phase emitter signal fed through R25 to provide an adjustment of reproduce phase shift to complement and cancel the phase shift which normally occurs during the recording process. FET switch Q7, normally "on," defeats this compensation, except at the one speed for which the adjustment is made. The calibration procedure is described on Pg. 8.

IC2 imparts voltage gain to the reproduce signal with R28, the REPRO CAL adjustment, providing a control over the gain as a means of ob-

taining a given output signal level for a variety of playback head outputs. This amplified signal is fed to the Line Amplifier.

Line Amplifier

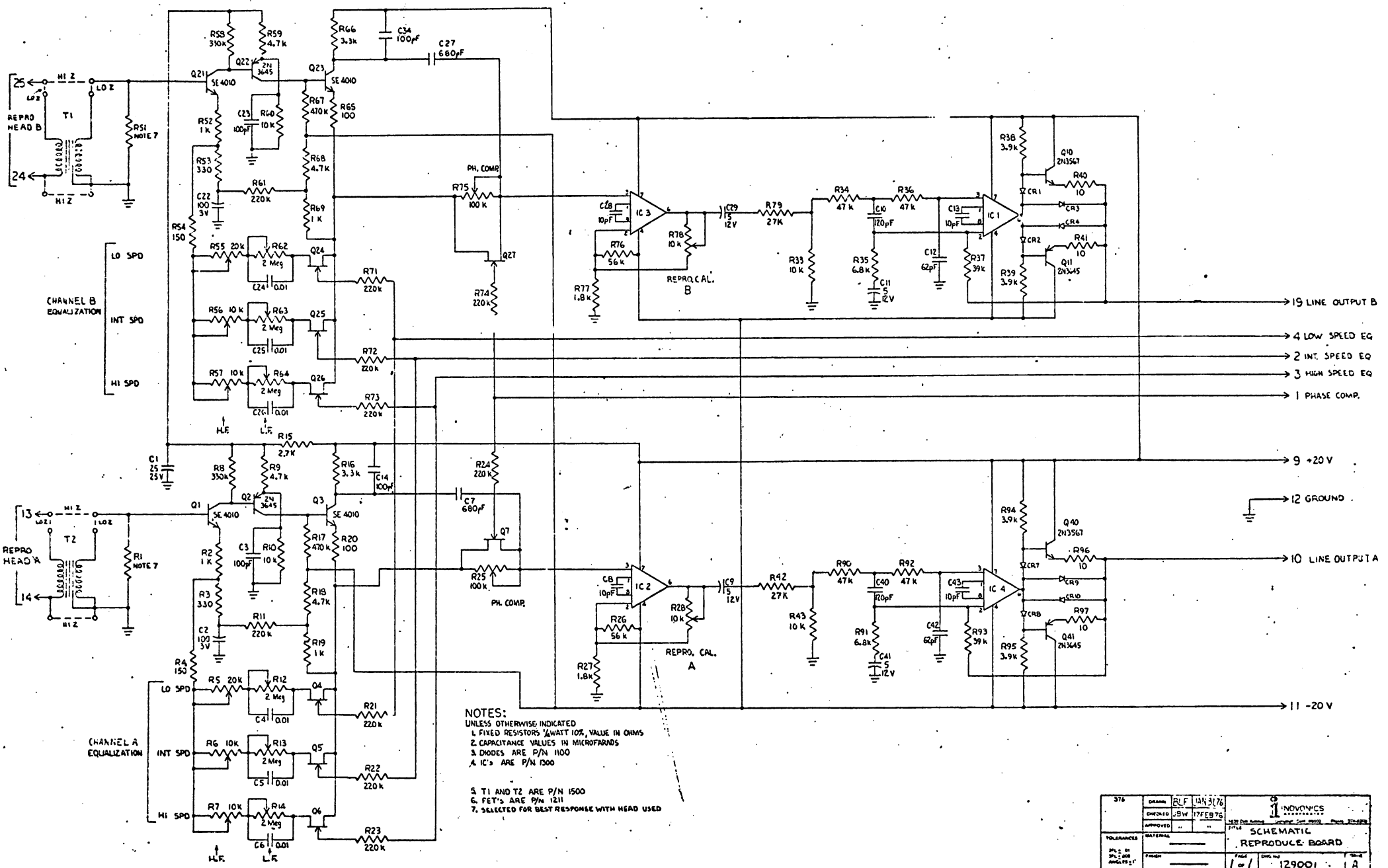
R90, 92, C40 and 42 are part of a 2-pole active low-pass filter with cutoff beginning at about 30kHz. This filter aids in reducing noise and other spurious signals outside the audio spectrum. IC4 performs the voltage gain function of the Line Amplifier, with gain established by feedback resistors R93 and 91. Transistors Q40, 41 and associated components provide the output current required for driving low impedance loads and long cables. Protection from output short circuits is afforded by diodes CR9 and 10.

SCHEMATIC REF. NO.	PART NUMBER	DESCRIPTION	MFG.	MANUFACTURER PART NUMBER
		CIRCUIT BOARD COMPONENTS		
C1	0904	CAPACITOR, 25uF, 25V	Sprague	TE 1207
C2, 22	0906	" 100uF, 3V	"	TE 1059.5
C3,14,23,44	0810	" 100pF	Elmenco	DM15-101J
C4-6, 24-26	0862	" 0.01uF	Sprague	225P10391
C7, 27	0820	" 680pF	Elmenco	DM15-681J
C8,13,28,43	0801	" 10pF	"	DM15-100J
C9,11,29,41	0901	" 5uF, 25V	Sprague	TE 1202
C10, 40	0811	" 120pF	Elmenco	DM15-121J
C12, 42	0832	" 62pF	"	DM15-620J
CR1-4, 7-10	1100	DIODE, 1N4009	Fairchild	
IC1-4	1300	INTEGRATED CIRCUIT, type 748-C	Signetics	N5748V
Q1,3,21,23	1210	TRANSISTOR, SE4010	Fairchild	
Q2,11,22,41	1205	" 2N3645	"	
Q4-7, 24-27	1211	" MPF111	National	
Q10, 40	1204	" 2N3567	"	

SCHEMATIC REF. NO.	PART NUMBER	DESCRIPTION	MFG.	MANUFACTURER PART NUMBER
R5, 55	0511	RESISTOR, Trimpot, 20K	Spectrol	43P20K
R6,7,28,56,57,78	0510	" " 10K	"	43P10K
R12-14, 62-64	0519	" " 2M	"	43P2MEG
R25, 75	0514	" " 100K	"	43P100K
		NOTE: All fixed resistors are 1/4w, 10%; value per schematic.		

SCHEMATIC REF. NO.	PART NUMBER	DESCRIPTION	MFG.	MANUFACTURER PART NUMBER
		CHASSIS COMPONENTS		
C1, 2	0872	CAPACITOR, .01uF, 600V	Sprague	6PS-S10
F1	2706	FUSE, 3A, 3AG		
F2	2702	" 1/2A, 3AG		
J1	1644	CONNECTOR, 6 pin "Jones" female	C/J	S-306-AB
J2	1707	" 25 pin P.C.	C/J	50-25A-20
J3, 4	1603	" "MS" 3-pin male	Amphenol	MS3102A10SL-3P
J5, 6	1609	" "XL" 3-pin male	Switchcraft	D3M
J7	1615	" 3-circuit phone jack	"	112B
J8, 9	1681	" 12-pin male	Molex	03-06-1112
M1, 2	2800	METER, VU	Modutec	23A-AVU-000-AB-KW/BA1
		NOTE: All fixed resistors are 1/4w carbon, value and tolerance per schematic.		

SCHEMATIC REF. NO.	PART NUMBER	DESCRIPTION	MFG.	MANUFACTURER PART NUMBER
S1	1817	SWITCH, slide SPDT	Cont. Wirt	GF 323/G-02-70
S2	1818	" 4-station pushbutton		
S3	1817	" slide, DPST	H.H. Smith	517
T1, 2	109000	TRANSFORMER, output		
T3	130100	" power		
		A/N 135400 - POWER SUPPLY		
C1, 2	0910	CAPACITOR, 500uF, 50V	Sprague	TVA1315
C3, 4	1053	" 2.2uF, 20V	Matsuo	DTSA-2002-225M
CR1-4	1125	DIODE, 1N4005	Fairchild	
IC1	1301	INTEGRATED CIRCUIT, 7818-C	National	LM7818-C
IC2	1302	" " 7918-C	"	LM7918-C



NOTES:
UNLESS OTHERWISE INDICATED
1. FIXED RESISTORS ¼WATT 10%, VALUE IN OHMS
2. CAPACITANCE VALUES IN MICROFARADS
3. DIODES ARE P/N 1100
4. IC's ARE P/N 1300
5. T1 AND T2 ARE P/N 1500
6. FET's ARE P/N 1211
7. SELECTED FOR BEST RESPONSE WITH HEAD USED

376	DRAWN BLF 13N3176	INOVONICS	
	CHECKED JBW 17FEB76		
	APPROVED		
TOLERANCES	MATERIAL	TITLE SCHEMATIC REPRODUCE BOARD	
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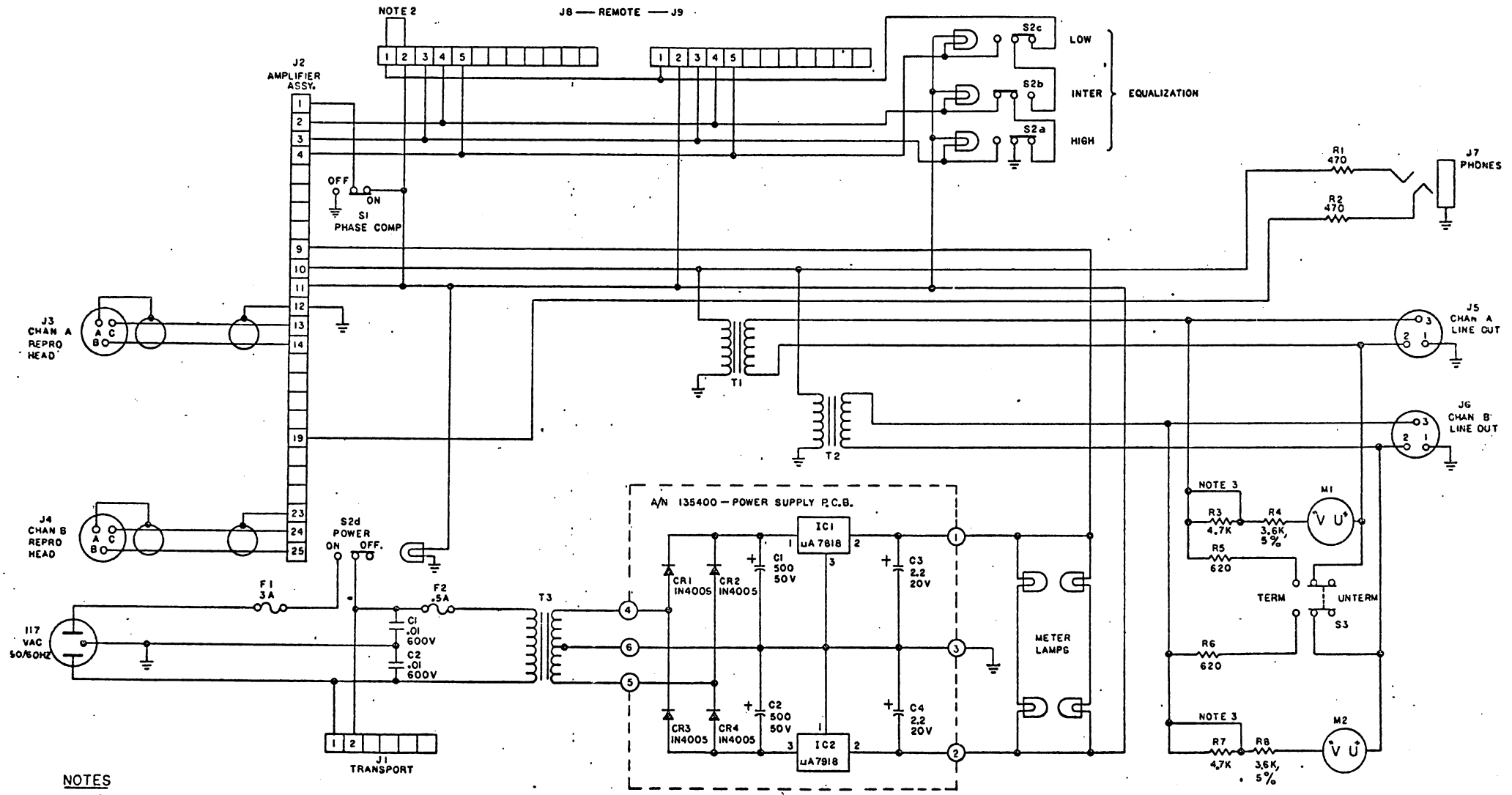

NOTES

1. UNLESS OTHERWISE SPECIFIED:
   A. RESISTORS ARE 1/4 W, 10%; VALUE IN OHMS
   B. CAPACITOR VALUES IN μF.
2. REMOVE SHORTING STRAP FOR REMOTE OPERATION.
3. REMOVE SHORTING STRAPS FOR +8dBm LINE LEVELS.

376	DRAWN AZTEC 6-22-76	INOVONICS	
	CHECKED JBW 6-22-76		
	APPROVED	TITLE	SCHEMATIC, CHASSIS
TOLERANCES	MATERIAL —		
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