

PRO-NOTE



NEW PRODUCTS - 6011/12

Hard on the heels of our 6021 and 6022 amplifiers discussed in Pro-Note 8, we are pleased to announce the availability of the JBL 6011 and 6012 100-watt power amplifiers.

Replacing the 6010B, these amplifiers share the same design features as the 6021 and 6022. The 6012 will deliver its rated power into 4-ohm loads from its direct-coupled output. The 6011 will additionally deliver full power into 8- and 16-ohm and 70.7-volt loads through its top-quality output transformer.

The designs of the 200-watt and 100-watt amplifiers are so similar that they even use the same printed circuit board. The differences are the number of output devices, the heat sink size and overall height, the transformer sizes and power supply capacity.

We are delighted with the performance of these new amplifiers. They will fill your often-expressed needs for reliability, simplicity, serviceability, quality and economy.

CROSSOVER CARDS

The 52-5120 blank card can be user-loaded with components for almost any practical crossover frequency. Even though we have provided the formula for calculation of the resistor and capacitor values required and have given some common frequencies, we are still asked for many values not on the chart.



To aid in constructing these cards, we are presenting the following list of various frequencies and the required components. The resistors should be 1/4 watt, 5% tolerance, and the capacitors should be 5% tolerance metalized polyester (Mylar). All listed values are commercially available, but the larger capacitor values are physically larger than the hole spacing on the board, so flush mounting will not be possible with these capacitors. See the manual supplied with the 5233 and 5234 for components available from JBL.

CROSSOVER CARD COMPONENT VALUES

Frequency (Hz)	Capacitors (μ F)	Resistors (k Ω)
50	.22	10
70	.22	7.5
100	.22	4.7
200	.12	4.7
300	.082	4.7
400	.055	5.1
600	.039	4.7
700	.032	5.1
900	.027	4.7
1000	.022	5.1
1100	.022	4.7
1500	.012	6.2
2000	.012	4.7
2500	.0082	5.6
3000	.0068	5.6
3500	.0068	4.7
4000	.0056	5.1
4500	.0039	6.2
5500	.0033	6.2
6000	.0033	5.6
6500	.0033	5.1
7500	.0027	5.6
8000	.0027	5.1
8500	.0012	11
9000	.0022	5.6
9500	.0012	10
10000	.0022	5.1

INSTALLATION-OF-THE-MONTH CLUB

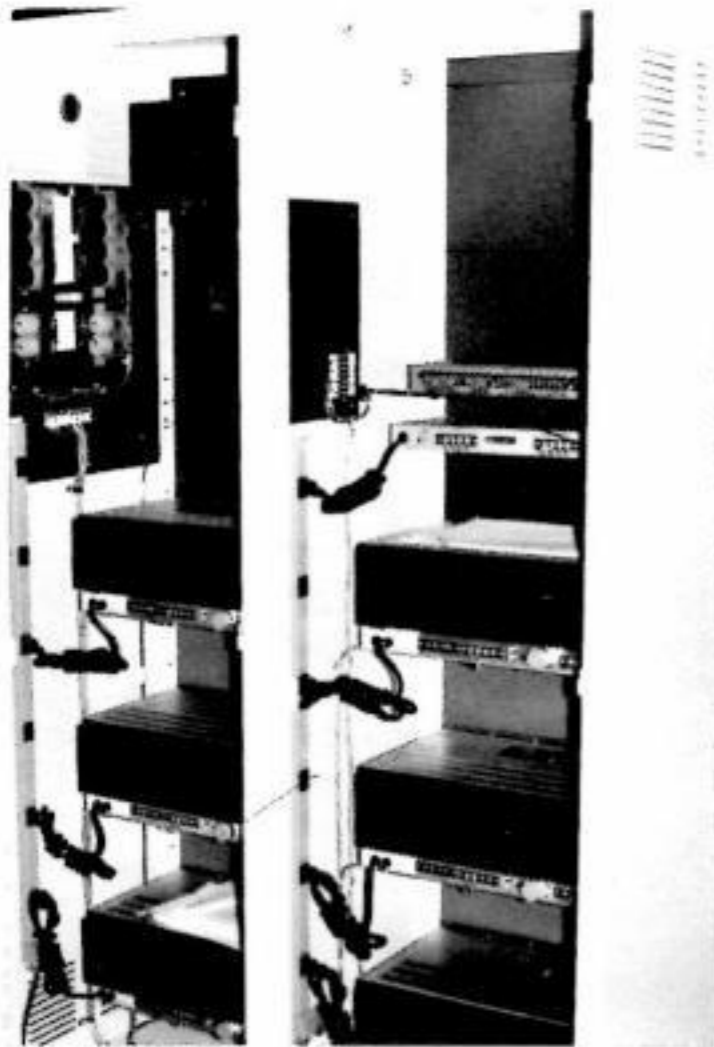
As promised, we will be featuring an interesting installation in each issue of Pro-Notes. This month's feature is an extremely successful design by Gray Sound & Communications of Pittsburgh, Pennsylvania, at the University of Pittsburgh.

Pitt Stadium is a 56,000-seat oval single-tier football stadium on the campus of the University. The sound system design objective was even speech coverage of the entire stadium from a single point, to avoid "double-talk" from multiple sources.

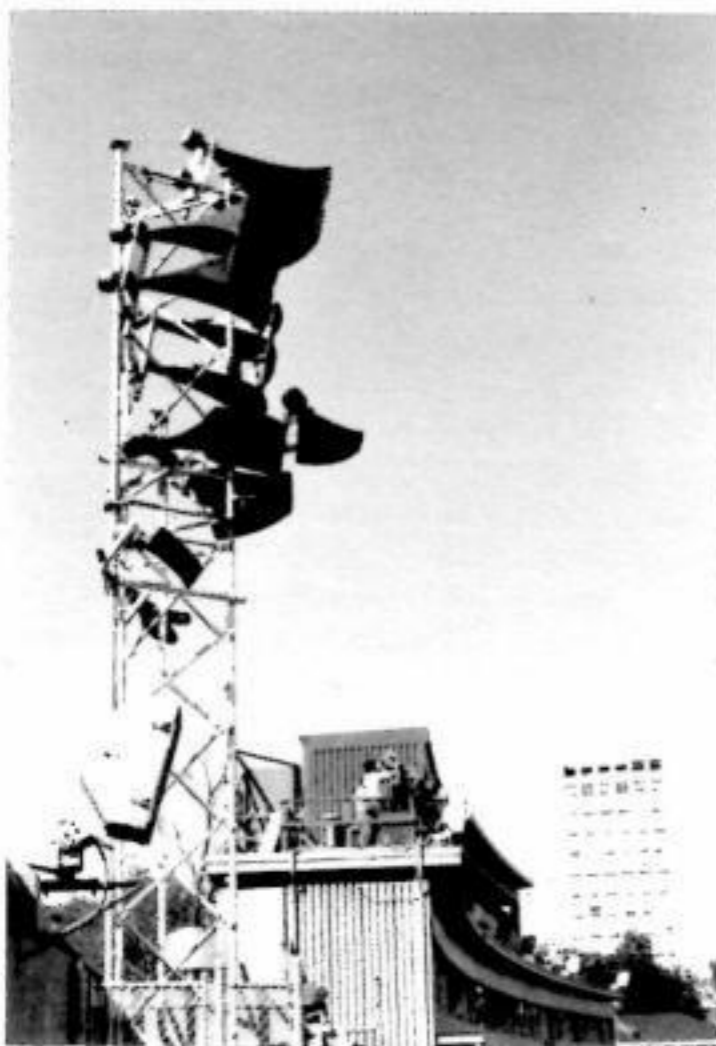
Gray Sound accomplished the task with surprisingly little equipment. Origination of program material from a public address announce microphone, a tape machine and an isolated feed from broadcasts are mixed by a JBL 5600-2B mixer-preamplifier. One mixer output goes to an isolation amplifier which feeds broadcasters and a monitor headset for the public address announcer. The main feed from the 5600-2B is connected in parallel to both inputs of a JBL 5234 dual-channel electronic crossover network through a 600:600-ohm isolation transformer.

Here is where the job gets interesting. Gray has installed a 500-Hz card in one channel of the 5234 and a 300-Hz card in the other channel, and has left the low frequency outputs unconnected. The 5234 is acting as a dual high-pass filter instead of a dividing network.

The 300-Hz high frequency output is fed through a 600:600 transformer to five JBL 6021 200-watt power amplifiers with JBL 5195 bridging input transformers installed. Three of the 6021s have paired JBL 2482 compression drivers across each, and the remaining two 6021s each feed one 2482. All of these 2482s are mounted on JBL 2356 horns, making the 300-Hz lower frequency limit both safe and practical. Of course, each driver has a 30- μ F protection capacitor in series with it.



The 500-Hz high frequency output of the 5234 feeds one 6021 through a 600:600 transformer and a JBL 5195 input transformer. The output of this 6021 is connected to three 2482s in parallel, each with its own 20- μ F protection capacitor. Two of the 2482s are mounted on JBL 2355 60-degree radial horns, and one is on a JBL 2350 90-degree radial horn. These horns are rated down to 500 Hz, making it necessary to restrict the bandwidth on these horns more than on the 2356s.



All of these horns are mounted on a single tower near the press box on the long rim of the stadium.

The only additional equipment in this system is a separate, isolated small speech system which feeds the individual positions in the press box.

With one mixer, one dividing network, six amplifiers and eleven horns, all 56,000 fans in the stadium are covered by clearly intelligible speech, even during the excitement of a game.

Congratulations to Gray Sound on an excellent installation.

Let us hear about your success stories. Please send full details on the job (including photographs) to Pro-Notes for consideration as part of this series. You'll be famous!

HP 67/97 PROGRAMS

Your Applications Engineer has recently acquired an HP 67 card-programmable calculator and has found it to be a tremendous aid in audio system design. For our own convenience, we have written programs which replace the numerical scales on the ever-popular JBL Slide Rule. These programs are:

1. dB vs. Voltage vs. Power (125 steps). Given any two of the following reference quantities: voltage, power and impedance, this program first calculates the third. This reference set may be defined as 0 dB or any quantity above or below that. Then, given any change in any of the following quantities: dB, voltage or power, the program will compute the other two. A subroutine defines 0 dB = 1 mW across 600 ohms at user option. (Expands the top scale of the JBL Slide Rule.)

2. Ohm's Law (110 steps). Given any two of the following variables: E, I, R (or Z) and P, this program calculates the third and fourth variables. (Expands Scale 2 of the Slide Rule. Duplicates a program already in the HP 67/97 Users' Library, a fact which was unknown at the time the program was written.)

3. Free-Field SPL (95 steps). Given the sensitivity of an audio transducer and any two of the following variables: free-field SPL, distance from the radiator and electrical power, this program calculates the third variable. Any parameter may be modified without re-entering the unchanged data. User-selected routines enter 1-W, 1-m or 1-mW, 30-ft conditions for sensitivity ratings. (Expands the bottom scale of the Slide Rule. Also available as Program No. 01357D from the HP 67/97 Users' Library.)

4. dB Addition and Subtraction (34 steps). Gives total level resulting from addition or subtraction of two non-coherent sources specified in decibels referred to the same reference quantity. (Not on the Slide Rule, but useful nonetheless.)

If you wish to obtain copies of these programs, drop a line to Pro-Notes and we will be happy to provide them at no charge.

We would appreciate receiving copies of audio-related programs which you have written for your programmable calculator. If enough people are interested, we might be able to set up our own library for exchanging audio programs.

PROTECTION CAPACITORS

As we hope you are aware, when a system is bi-amplified (or tri-amplified), protection capacitors should be installed in series with compression drivers to protect them against damage from low frequencies originating in the power amplifier (hum, turn-on transients, turn-off transients, DC offsets, etc.). If you wish additional information on this topic, we suggest that you read the Technical Manual supplied with our 5233 and 5234 active dividing networks. Let us know if you need a copy of this manual.

On our recent tour through Europe, several distributors asked us for precise capacitor specifications for protection service, since they prefer to obtain these parts locally if possible rather than from JBL.

We use both Mylar dielectric and non-polarized electrolytic capacitors for this application. Mylar capacitors are much more expensive than electrolytics in large values and are not easy to find. Fortunately, non-polarized electrolytics are quite suitable as long as they meet the following specifications:

1. The minimum breakdown voltage should be 100 volts.
2. The capacitance should be rated at 1 kHz. Often, electrolytics are specified at 50 or 60 Hz and their values at the frequencies of interest to us can deviate quite a bit.
3. The rated tolerance should be ± 10 -15%.
4. The temperature rating should be from -20°C to +65°C. In our experience, capacitors carrying lower maximum ratings are not of sufficient quality or reliability.
5. The D-factor (related to the internal resistance) should be no higher than 10% at 1 kHz.

There are many capacitor manufacturers throughout the world, and we do not have sufficient information to make recommendations on specific brands. The capacitors we use are made to our electrical and physical specifications under contract. There may be a number of manufacturers who carry standard capacitors suitable for this application of whom we have no knowledge. The above specifications will insure that the capacitor will be fully suitable for driver protection.

Please remember that JBL studio monitors designed for bi-amplification already have protection built in where required and no additional protection is needed.

The following is a list of the capacitors we currently stock which can be used for driver protection in multi-amplified systems.

For Optimum Results At:

Value (μ F)	JBL Part No.	16 Ω	8 Ω	4 Ω
72	52938	275 Hz	550 Hz	1100 Hz
52	52939	400	750	1500
36	57801	500	1100	2000
24	57657	800	1600	3000
20	53881	1000	2000	4000
16.5	10358	1200	2500	5000
13.5	10359	1500	3000	6000
12	10434	1700	3500	7000
10	57588	2000	4000	8000
8	10391	2500	5000	10000
7	57529	3000	6000	11000
6	10296	3500	7000	13000
5	57587	4000	8000	—
4	41040	5000	10000	—
3	11937	7000	13000	—

The optimum value cited above assumes that the capacitor is active at approximately one octave below the listed crossover frequency for minimum acoustical interference with crossover region performance. Smaller capacitor values may be required for additional protection in high-power reinforcement.

DC POWER

From time to time, we are asked about operating JBL professional electronic products, particularly our power amplifiers, on DC for emergency backup purposes.

Each of our new power amplifiers has a back panel space (covered by the JBL foical) for installation of a connector for DC power, and there are several additional modifications which must be made. We will be happy to supply details on request.

Please note, however, that the laws of physics and the conservation of energy require some exotic battery voltages to achieve full power output from a high-power amplifier. The 6021 and 6022 require ± 70 V DC at 3.2 amperes to achieve their full 200-watt outputs. The 6011 and 6012 need ± 48 V DC at 2.8 amperes for full 100-watt output, and the 6007 and 6008 (which will be available sometime in mid-year) will need ± 36 V DC at 2.2 amperes for full 60-watt output.

One of our esteemed competitors claims that his 200-watt amplifier requires only 24 V DC, which is a very good trick when working with conventional output impedances and no

inverter. The trick is that the amplifier will operate, but will put out only a fraction of its rated power capability. Our 6021 and 6022 are marked at ± 48 V DC, which is somewhat below the ± 70 V required for full output, but will give quite usable output in emergency situations.

CONTRACTOR'S CORNER

Bill Speck of Speck Engineering in Riverside, California, has come up with an excellent suggestion to use in preparing system specifications. Bill points out that the interchangeable module concept incorporated in the new JBL power amplifiers is unique. It then becomes a simple matter to specify against the other guys by writing in the specification that one spare audio amplifier module be part of the system for rapid interchange in case of difficulty. In order to meet this specification, the other guys will have to provide a complete amplifier, since their units are not modular.

Here is a sample specification which you may adapt for your own requirements:

Each power amplifier shall have all active audio circuitry, except for transformers and meter, contained on one printed circuit board with attached heat sink. The PCB/heat sink assembly shall be removable and replaceable from the rear of the amplifier, using a screwdriver, without removing the amplifier from the rack. One PCB/heat sink assembly (for multiple amplifier types: of each type) shall be provided as a spare (spares) for rapid substitution in case of difficulty.

Our thanks to Bill Speck for passing this idea along. We'd like to hear from more of you. Just think...you too can be enshrined in print!

JBL SOUND WORKSHOP

JBL is pleased to announce that the long-touted JBL Sound Workshop is on the road!

This three-day workshop in sound system design procedures has been developed by George Augspurger of Perception, Inc., and Walter Dick, JBL's Transducer Engineering Manager (not to mention former Pro-Note author), in collaboration with the JBL Professional Division.

The 1978 schedule is as follows:

February 20-22	Los Angeles, CA
March 20-22	Houston, TX
April 10-12	Atlanta, GA
July 10-12	Montreal, PQ
August 14-16	Kansas City, MO
September 11-13	Vancouver, BC
October 16-18	Chicago, IL

For information on cost and a reservation form, write or telephone Ewald Consen at JBL. We may have to change the above schedule due to circumstances beyond our control, but we hope that won't be necessary.

We haven't forgotten our international friends. Plans are now underway for seminars in Europe and Australia, but these are not yet final. Your JBL distributor will have details on when, where and how much as soon as arrangements are completed.

BACK ISSUES

A number of people have written to us requesting back issues of Pro-Notes. We're sorry to inform you that our supply of the first seven issues of Pro-Notes has been exhausted because of the long time span between Pro-Note 7 and Pro-Note 8.

Perhaps we will be able to reprint the relevant articles from past issues in a sort of "Best of Pro-Notes" number some time in the future. Stay tuned.

ELECTROLYTIC FORMING

Some dealers are talking about stockpiling electronic equipment for protection against possible future price increases.

One problem with this approach, besides inventory and obsolescence, is deformation of electrolytic capacitors. Over several years on the shelf, electrolytics tend to deform and draw excessive current.

All JBL electronic products are burned in using a procedure for insuring that the capacitors are properly formed when shipped, and their shelf lives without reformation are at least two or three years.

If, however, any electronic product which has been unused for some time blows its line fuse upon turning on the power, capacitor deformation can be suspected, and reformation can be achieved using the following procedure:

Replace the power fuse, connect a load to the output, set gain controls at minimum, and plug the unit into a variable power transformer such as a Variac. Set the transformer at 50 V (100 V if this unit is set for 240-V operation) and turn on the power. If the fuse blows again, capacitor deformation is not the problem. If the fuse remains intact, let the unit run at 50 V (100 V) for a half hour, and then increase the supply voltage in 25-V (50-V) steps at half-hour intervals until 120 V (240 V) is reached. After full supply voltage is reached, allow the unit to run for 4 to 6 hours. The capacitors should then be fully formed and ready to go for another couple of years of shelf life. Of course, if the unit is put into regular service, reformation is then a continuing process and the above procedure will not be needed again.

OEM DIAPHRAGM NUMBERS

JBL has sold a number of drivers to original equipment manufacturers, sometimes with special numbers. For your information, the following is a list of past and present OEM specially numbered drivers, and the replacement diaphragms available from JBL:

OEM NAME	DRIVER #	JBL REPLACEMENT DIAPHRAGM
DuKane	5A350	D16R5A350
	5A355	D16R5A355
	5A360	D16R2440
	5P350	D16R5P350
	5P355	D16R2470
	5P360	D16R5P360
Heath	401-132	D8R401132
RCA	M1-11419	D16R2410
	M1-11426A	D16R5P360
	M1-11427	D16R2440
Sunn Transducers, Inc.	LE100S	D16R2460
	375H	D16R2440

Diaphragms for drivers we manufacture for General Railway Signal or Tideland Signal are available only through those companies.

DIAPHRAGM INTERCHANGEABILITY

From time to time, every audio contractor has run into emergency situations when a diaphragm has blown out and there is neither a replacement available nor time to order one.

In an effort to assist in such times, we are presenting the following list of drivers and the substitute diaphragms which can be installed:

DRIVER	DIAPHRAGM	ACOUSTICAL EQUIVALENT
2410	D16R2420	None
	D16R2460	2460
	D16R2470	2461
2420	D16R2410	None
	D16R2460	None
	D16R2470	2470
2440	None	
	2460	
2460	D16R2410	2410
	D16R2420	None
	D16R2470	2461
2461	D16R2410	2410
	D16R2420	None
	D16R2460	2460
2470	D16R2410	None
	D16R2420	2420
	D16R2460	None
2480	D16R2482	2482
	2482	2480

In the combinations where an acoustical equivalent is given, the driver with that diaphragm installed will have electrical and acoustical specifications identical to its equivalent. The remaining combinations will make sounds but are recommended for emergency use only—the response will not be of the quality normally expected from JBL equipment.

Two cautions:

1) In any case where a substitution has been made, this fact should be prominently marked on the driver, since the change is otherwise not externally visible.

2) Since system response will change markedly, any equalization parameters will have to be reworked for reasonable results.

JBL will not make these substitutions at the factory. We can only replace diaphragms with the types intended for those drivers as indicated by the foical.

2330

The 2330 adaptor allows mounting of JBL 2-inch throat drivers onto Altec 1.4-inch throat horns, for those situations where the green horn is required. The following are the Altec horns to which the 2330 is applicable: 203B, 311-60, 311-90, 319A, 329A, 803B, 805, 1003B, 1005B, and 1505B. This list is intended as a rough guide. We have not attempted to show all possible combinations of throats, gaskets and other plumbing required to complete an installation.

4-OHM K130

The last Pro-Note announced the discontinuation of a number of loudspeakers because of low sales volume, including all 4-ohm K Series speakers.

We have received quite a number of requests for reinstatement, primarily for the 4-ohm K130, and we have already received orders for more 4-ohm K130's than we sold in all of last year.

Effective immediately, we have reinstated the K130 in 4 ohms into our line for a one-year trial period. If the sales volume remains viable during this time, we will be happy to continue manufacturing this unit.



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PN 2/78 Printed in U.S.A.