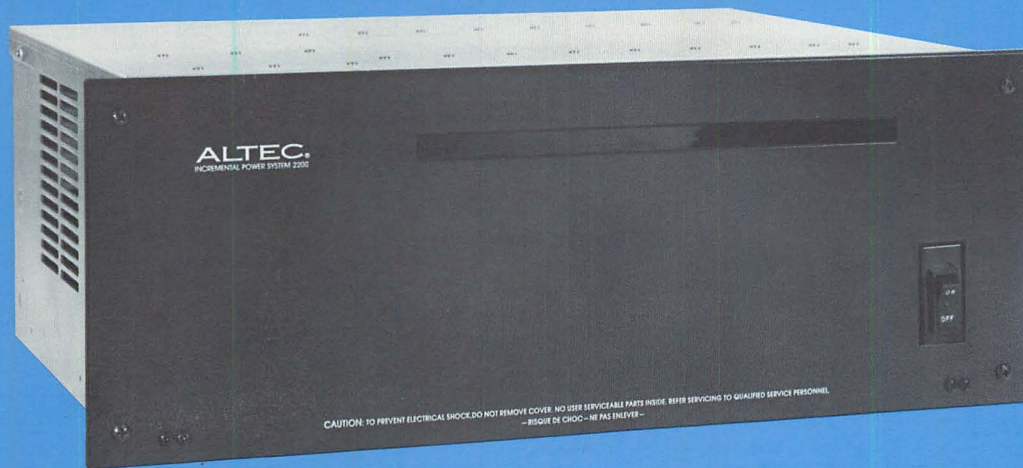


ALTEC
LANSING

INCREMENTAL™ POWER SYSTEM

Reg. U.S. Reg. Pat. No. 4,081,757



DESCRIPTION

Altec Incremental Power is a power amplifier system. The main frame is a 7" rack-mount card cage which contains up to eight 75-watt power amplifiers, an electronic crossover, a balanced or unbalanced input card, and special driver amplifiers with matrix switching for console-like signal processing.

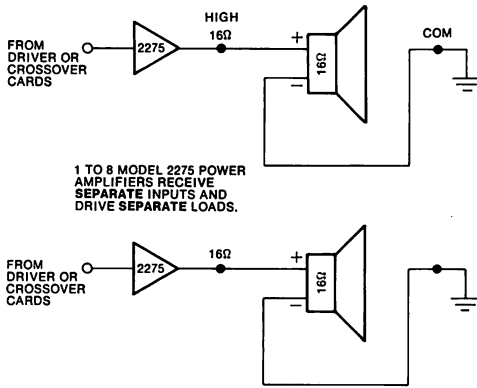
The eight power amplifiers can be combined in increments of 75 watts to meet almost any conceivable audio application: in parallel mode to drive high-power, low-impedance loads; in bridged mode to drive balanced 70-volt lines;

and parallel/bridged mode to drive high-power balanced 70-volt lines, or other high-power loads.

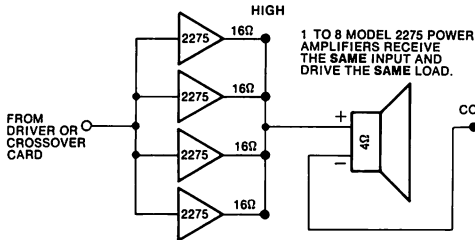
Incremental Power is the ability to: 1) Control high-, mid- and low-frequency loudspeakers with separate power amplifiers. 2) Connect far-, middle- and near-throw horns to separate power amplifiers with separate level controls. 3) Power up to four separate balanced 70-volt systems from a single card-cage main frame. 4) Power extremely complex sound systems by combining the abilities of two or more Incremental Power Systems.

Model 2275 Power Amplifier Modules

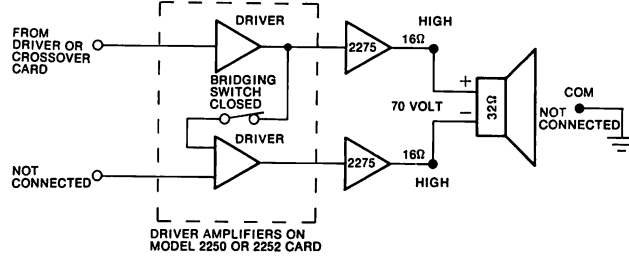
Independent Mode



Parallel Mode

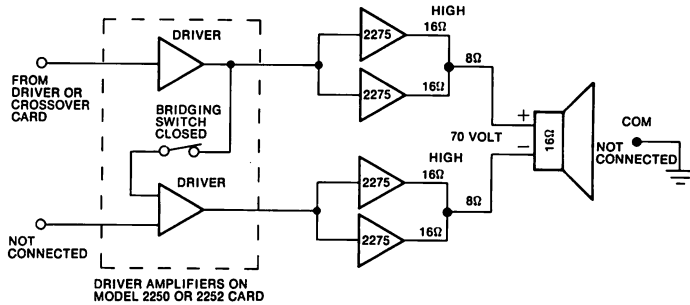


Bridged Mode



2 MODEL 2275 POWER AMPLIFIERS RECEIVE OUT-OF-PHASE INPUTS AND DRIVE THE SAME LOAD

Parallel/Bridged Mode

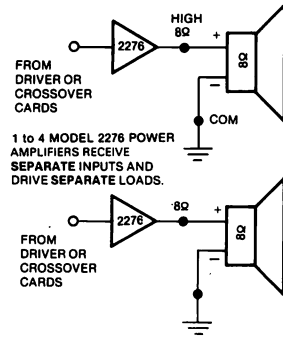


2 SETS OF UP TO 4 PARALLEL MODEL 2275 POWER AMPLIFIERS PER SET RECEIVE "OUT OF PHASE" INPUTS AND DRIVE THE SAME LOAD

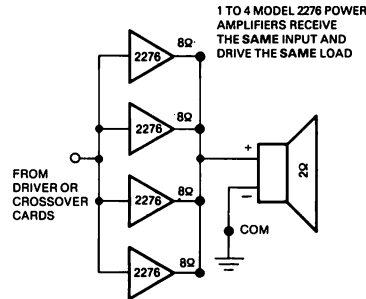
Figure 1. Operational Modes for Model 2275 Power Amplifiers.

Model 2276 Power Amplifier Modules

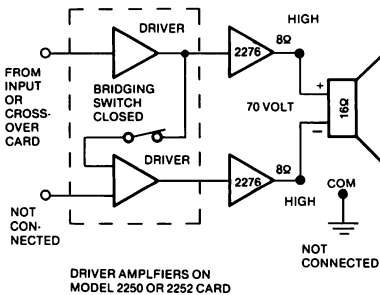
Independent Mode



Parallel Mode

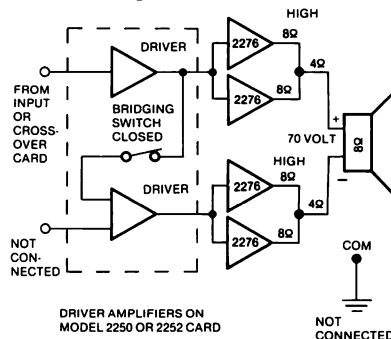


Bridged Mode



2 MODEL 2276 POWER AMPLIFIERS RECEIVE OUT-OF-PHASE INPUTS AND DRIVE THE SAME LOAD.

Parallel/Bridged Mode



2 SETS OF 2 MODEL 2276 POWER AMPLIFIERS PER SET RECEIVE "OUT OF PHASE" INPUTS AND DRIVE THE SAME LOAD.

Figure 2. Operational Modes for Model 2276 Power Amplifiers.

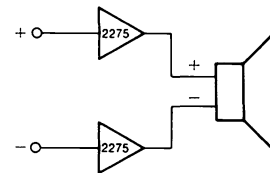
Model 2275 Power Amplifier Modules*

Independent Operation

Rated Power Output	Rated Load Impedance	Rated RMS Sine-wave Voltage Output
75 watts	16 ohms	35 volts

Bridged Operation

Rated Power Output	Rated Load Impedance	Rated RMS Sine-wave Voltage Output
150 watts	32 ohms	70 volts

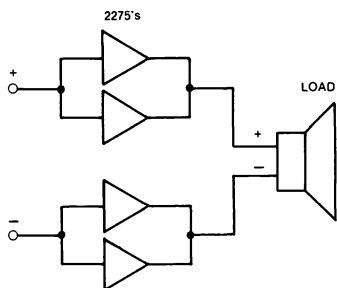


Parallel Operation

Number of Parallel Model 2275 Power Amplifiers

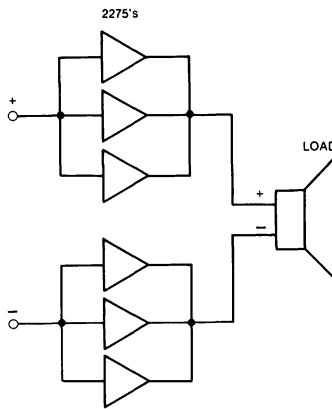
	1	2	3	4	5	6	7	8
Rated Power Output	75 watts	150 watts	225 watts	300 watts	375 watts	450 watts	525 watts	600 watts
Rated Load Impedance	16 ohms	8 ohms	5.3 ohms	4 ohms	3.2 ohms	2.7 ohms	2.3 ohms	2 ohms
Rated RMS Sine-Wave Voltage Output	35 volts	35 volts	35 volts	35 volts	35 volts	35 volts	35 volts	35 volts

Parallel/Bridged Operation



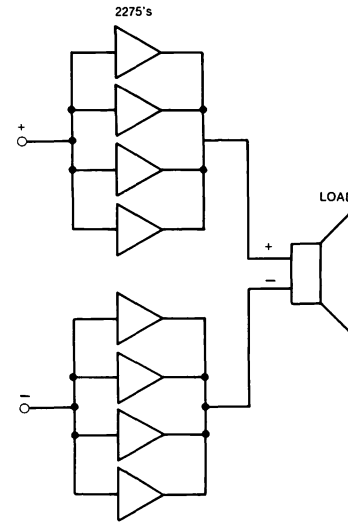
2 SETS OF (2) 2275's (4 TOTAL)

Rated Power Output	Rated Load Impedance	Rated RMS Sine-wave Voltage Output
300 watts	16 ohms	70 volts



2 SETS OF (3) 2275's (6 TOTAL)

Rated Power Output	Rated Load Impedance	Rated RMS Sine-wave Voltage Output
450 watts	10 2/3 ohms	70 volts



2 SETS OF (4) 2275's (8 TOTAL)

Rated Power Output	Rated Load Impedance	Rated RMS Sine-wave Voltage Output
600 watts	8 ohms	70 volts

*Internal modifications (See Operating Instructions) convert the 2275's for operation into 8-ohm loads. For this modification, change the specifications for the various operational modes as follows: Rated Power Output—remains the same; Rated Load Impedance X 1/2; Rated RMS Sine-Wave Voltage Output X 0.707.

Figure 3. Power Output, Load Impedance and Voltage Output for Various Combinations of Power Amplifier Modules.

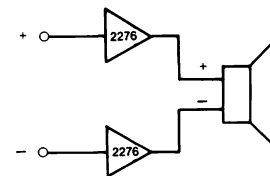
Model 2276 Power Amplifier Modules

Independent Operation

Rated Power Output	Rated Load Impedance	Rated RMS Sine-wave Voltage Output
150 watts	8 ohms	35 volts

Bridged Operation

Rated Power Output	Rated Load Impedance	Rated RMS Sine-wave Voltage Output
300 watts	16 ohms	70 volts



Parallel Operation

	Number of Parallel Model 2276 Power Amplifiers			
	1	2	3	4
Rated Power Output	150 watts	300 watts	450 watts	600 watts
Rated Load Impedance	8 ohms	4 ohms	2.65 ohms	2 ohms
Rated RMS Sine-Wave Voltage Output	35 volts	35 volts	35 volts	35 volts

Parallel/Bridged Operation

2 SETS OF (2) 2276's (4 TOTAL)

Rated Power Output	Rated Load Impedance	Rated RMS Sine-Wave Voltage Output
600 watts	8 ohms	70 volts

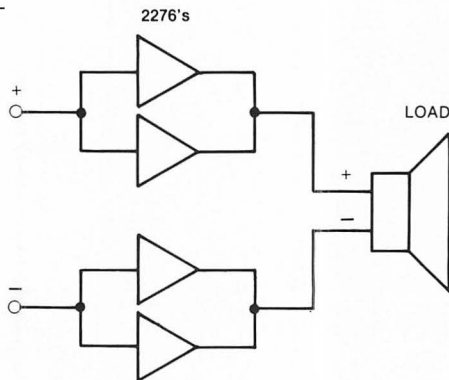
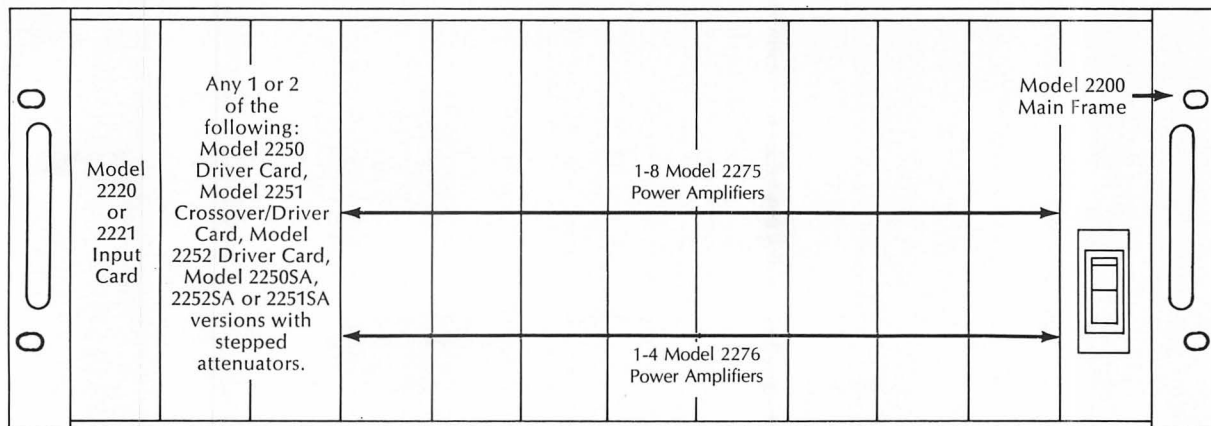


Figure 4. Power Output, Load Impedance and Voltage Output for Various Combinations of Power Amplifier Modules.

Incremental Power System Ordering Information

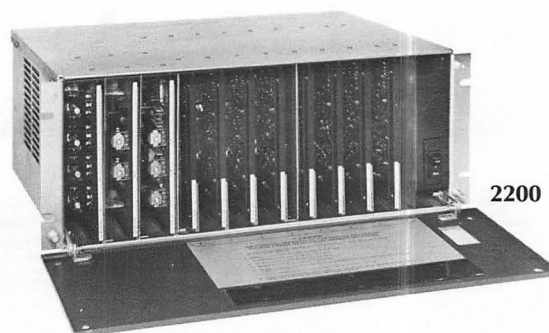
Model #	Model 2200 Main Frame	Model 2220 Input Card	Model 2221 Input Card	Model 2250 or 2250SA Driver Card	Model 2252 or 2252SA Driver Card	Model 2251 or 2251SA Crossover/Driver Card	Model 2275 Power Amplifier	Model 2276 Power Amplifier
Order Quantity	1 (required)	1 (or 2221)	1 (or 2220)	Any combination of 1 or 2 of these cards (at least 1 is required)			1-8 as needed	1-4 as needed



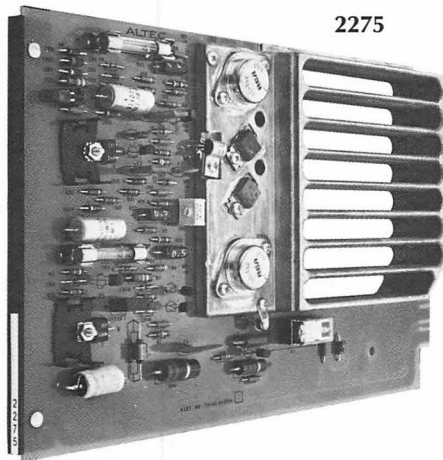
POWER AMPLIFIERS

Each Model 2200 Main Frame can hold up to eight Model 2275 Power Amplifiers, or up to four Model 2276 Power Amplifiers. These amplifiers operate in any of four modes:

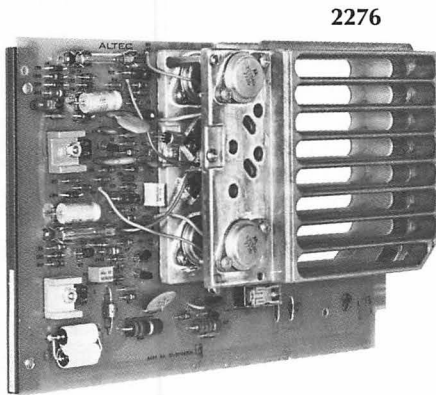
1. Independent—In this mode, each Power Amplifier receives a separate input signal and drives a separate load. Refer to the preceding tables for rated power output and load impedance for the Models 2275 and 2276 Power Amplifiers.



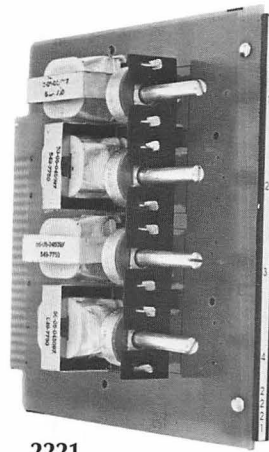
2. Parallel—In this mode, two or more power amplifiers receive one (common) input signal and drive one (common) load. See Figures 1 through 4.
3. Bridged—In this mode, two power amplifiers are driven "out-of-phase" with each other producing a balanced 70-volt output with the speaker load connected to the "hot" terminals of the two amplifiers. See Figures 1 through 4.
4. Parallel/Bridged—Two sets of parallel power amplifiers can be bridged for a high-power 70-volt balanced output. See Figures 1 through 4.



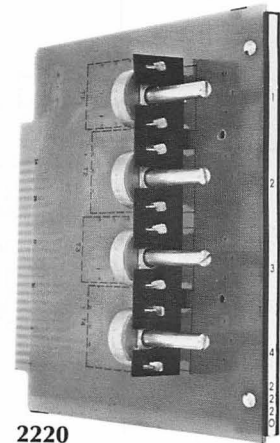
2275



2276

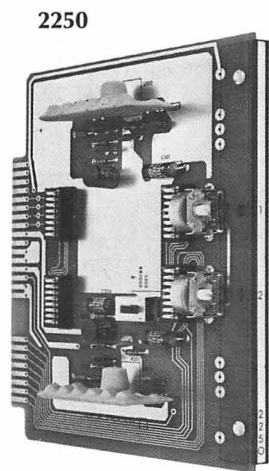


2221

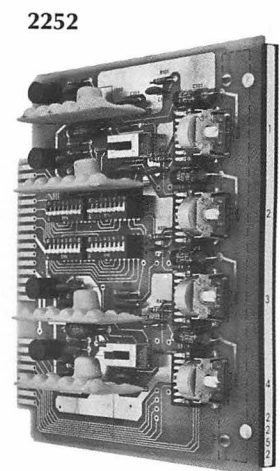


2220

The Model 2250 Driver Card includes two driver amplifiers, an input switching matrix and an output switching matrix. The Model 2252 Driver Card includes four driver amplifiers, an input switching matrix and an output switching matrix.



2250



2252

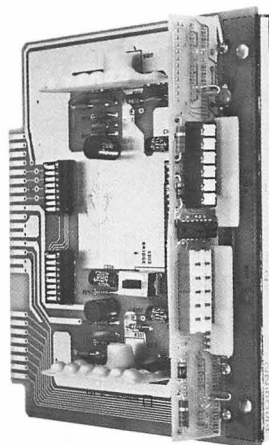
Figures 3 and 4 show charts summarizing the power output capabilities of the various combinations of 2275 and 2276 Power Amplifiers. The voltage output specifications allow you to calculate the power delivered into a loudspeaker load whose impedance is higher than the rated impedance listed on the Chart. $Power = (Voltage)^2 / (Impedance).$ *

INPUTS

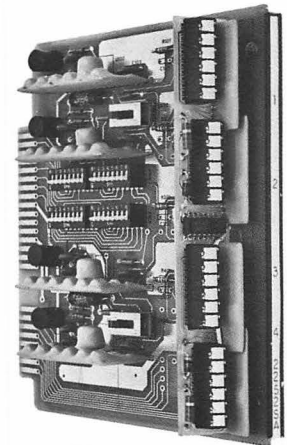
The Incremental Power System has four primary inputs which can be balanced or unbalanced with a Model 2221 (Transformer Isolated) Input Card or unbalanced with a Model 2220 (Transformerless) Input Card. Each of these four primary inputs has a screwdriver-adjustable attenuator. Alternately, the Incremental Power System will accept up to eight unbalanced inputs through four stereo "Special Input/Output" jacks. In this case neither model Input Card is required.

DRIVERS

Special "driver amplifiers" feed the inputs to the power amplifiers. Combinations of these driver amplifiers allow the power amplifiers to be paralleled, bridged, or run independently. The Model 2251 Crossover Card includes three driver amplifiers and an output switching matrix.



2250SA

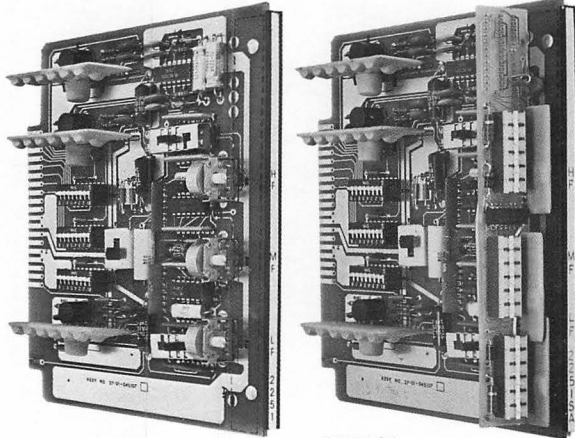


2252SA

CROSSOVER/DRIVER

The Model 2251 Crossover/Driver Card is a plug-in, two-way or three-way electronic crossover with selectable crossover frequencies at 625 Hz, 800 Hz, 1250 Hz and 1600 Hz (Low-Mid) and at 3150 Hz, 4000 Hz, 5000 Hz and 8000 Hz

2251



2251SA

(Mid-High). The slope rate is fixed at 12 dB per octave.

The "HIGH", "MID" and "LOW" frequency outputs have screwdriver-adjustable attenuators. The Model 2251 can drive the power amplifiers directly, or can be used in conjunction with either Model 2250 or 2252 Driver Card. The Incremental Power System Main Frame will accept either one or two Model 2251 Crossover Cards for a monaural or stereo bi-amplified or tri-amplified system. Alternately, the Incremental Power System will accept either one or two Driver Cards, or a Driver Card and a Crossover Card.

STEPPED ATTENUATOR OPTIONS

Model 2250SA and 2252SA Driver Cards, and Model 2251SA Crossover/Driver card have DIP-style (dual-inline package switches) stepped attenuators in place of continuously variable potentiometers. These stepped attenuators can attenuate incoming signals as much as 63dB in 1dB steps.

SPECIFICATIONS

OVERALL INCREMENTAL POWER SYSTEM SPECIFICATIONS

Voltage Amplification (Maximum)

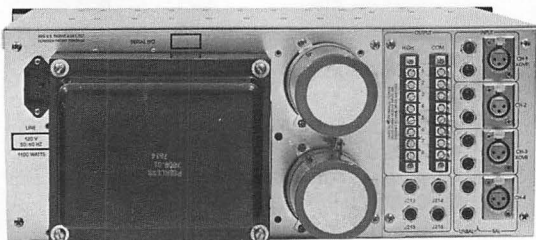
From input of Model 2220 Input Card through Model 2250 or 2252 Driver Card to output of Model 2275 or 2276 Power Amplifier.

35.0 dB in independent or parallel mode, 41.0 dB in bridge or parallel/bridge mode (all attenuators at full CW rotation).

Voltage Amplification (Maximum)

From input of Model 2220 Input Card through Model 2251 Crossover Card to output of Model 2275 or Model 2276 Power Amplifier.

35.0 dB to output of power amplifiers assigned to the "Low" output of the 2251 Crossover Card; 36.7 dB to output of power amplifiers assigned to the "Mid" output of the 2251 Crossover Card; 47.0 dB in Bi-amplifier, 50.6 dB in Tri-Amplifier to output of 2275 Power Amplifiers assigned to the "High" output of the 2251 Crossover Card; 35.0 dB to output of power amplifier in bi-amplifier mode using full range channel (MF channel of 2251 driver). (Values apply to 2275 Power Amplifiers in independent or parallel mode; add 6 dB to values for 2275 Power Amplifiers used in bridge or parallel/bridge modes; all values assume full CW rotation of appropriate attenuators.)



Voltage Amplification (Maximum)

From input of Model 2220 Input Card through Model 2251 Crossover Card to Special Input/Output Jacks J213, J214 or J215.

+15.0 dB to J213 ("High" output); +11.5 dB to J214 ("Mid" output); -0.5 dB to J215 ("Low" output). (All attenuators at full CW rotation.)

Minimum Load Impedance

For Special Input/Output Jacks 213, 214, and 215.

3000 ohms.

Voltage Amplification (Maximum)

From special Input/Output Jacks J213, J214, J215 or J216 through 2250 or 2252 Driver Card to output of power amplifier.

35.0 dB in independent or parallel mode; 41.0 dB in bridge or parallel/bridge mode. (All attenuators at full CW rotation.)

Input Sensitivity

Input voltage needed at 2220 Input Card inputs for rated output from power amplifier with 2250 or 2252 Driver Card.

-2.0 dB* (0.61V) for Model 2275 16Ω operation or for Model 2276 8Ω operation, -4.9 dB (0.44V) for Model 2275 8Ω operation or for Model 2276 4Ω operation with appropriate attenuators at maximum CW rotation; Input Sensitivity is the same for all power amplifier operational modes.

Input Sensitivity

Input voltage needed at 2220 Input Card inputs for rated output from power amplifier with Model 2251 Crossover Card.

-2.0 dB (0.61V) for Model 2275 16Ω operation or for Model 2276 8Ω operation, -4.9 dB (0.44V) for Model 2275 8Ω operation, or for Model 2276 4Ω operation with appropriate attenuators at maximum CW rotation; Input Sensitivity is the same for all power amplifier operational modes.

Input Impedance

At Special Input/Output Jacks J213, J214, J215, J216 with Model 2250 or 2252 Driver Card.

29K ohms

*In these specifications, when dB represents a specific voltage, 0 dB is referenced to 0.775 volts rms. 0 dBm is a power level referenced to 1 mW (0.775 volts driving a 600-ohm termination). For example, when 6.16 volts drives a high impedance, the level is designated "+18 dB (6.16V)." When 6.16 volts drives a 600-ohm termination, the level is designated "+18 dBm".

Input Sensitivity

Input Voltage needed at Special Input/Output Jacks J213, J214, J215 or J216 for maximum output from power amplifier with 2250 or 2252 Driver Card.

AC Power Requirements

(2200 Main Frame with 8-Model 2275 power amplifiers (or 4-Model 2276 power amplifiers, or any combination of 2275 and 2276 power amplifiers totally filling the 2200 Main Frame), Model 2221 Input Card, Model 2252 Driver Card.)

Export Conversion Voltages

Connectors (Main Frame)

Controls and Indicators (Model 2200 Main Frame)

Dimensions and Weights

	Full Model 2200 Main Frame	Empty Model 2200 Main Frame	Model 2220 Input	Model 2221 Input	Model 2250 Driver	Model 2252 Driver	Model 2251 Crossover/Driver	Model 2275 Power Amplifier	Model 2276 Power Amplifier
Weight	70 lb (31.7kg)	56 lb (25.4kg)	6 oz (170gm)	17 oz (481gm)	5 oz (141gm)	7 oz (198.4gm)	7 oz (198.4gm)	24 oz (680.4gm)	2 lb 12 oz (1.25kg)
Length	17 $\frac{3}{8}$ " (447.7mm)	17 $\frac{3}{8}$ " (447.7mm)	5 $\frac{1}{2}$ " (140mm)	5 $\frac{1}{2}$ " (140mm)	5 $\frac{1}{2}$ " (140mm)	5 $\frac{1}{2}$ " (140mm)	5 $\frac{1}{2}$ " (140mm)	10 $\frac{1}{8}$ " (257.2mm)	10 $\frac{1}{8}$ " (257.2mm)
Width	19" (483mm)	19" (483mm)	1 $\frac{3}{8}$ " (34.9mm)	1 $\frac{3}{8}$ " (34.9mm)	1-5/16" (33.3mm)	1-5/16" (33.3mm)	1-5/16" (33.3mm)	1 $\frac{1}{4}$ " (31.3mm)	2 $\frac{5}{8}$ " (66.6mm)
Height	7" (178mm)	7" (178mm)	6 $\frac{1}{2}$ " (165.1mm)	6 $\frac{1}{2}$ " (165.1mm)	6 $\frac{1}{2}$ " (165.1mm)	6 $\frac{1}{2}$ " (165.1mm)	6 $\frac{1}{2}$ " (165.1mm)	6 $\frac{1}{2}$ " (165.1mm)	6 $\frac{1}{2}$ " (165.1mm)

Finish (Front panel of 2200 Main Frame)

Altec Green

MODEL 2275 POWER AMPLIFIER SPECIFICATIONS*

Individual Model 2275 Driven by Model 2250 or 2252 Driver Card with Model 2220 Input Card

Eight Model 2275's in Parallel/Bridge Mode Driven by Model 2250 or 2252 Driver Card with Model 2220 Input Card

Power Output	75 watts continuous average sine wave power into a 16-ohm load impedance.	600 watts continuous average sine wave power into an 8-ohm load impedance.
Power Output at Clipping	90 watts at 1 kHz into a 16-ohm load impedance	675 watts at 1 kHz into an 8-ohm load impedance
Frequency Response	+0, -0.5 dB from 20 Hz to 20 kHz	+0, -0.5 dB from 20 Hz to 20 kHz
Total Harmonic Distortion	Less than 0.25% from 20 Hz to 15 kHz Less than 0.03% at 1 kHz, 75 watt output into 16-ohms	Less than 0.25% from 20 Hz to 15 kHz Less than 0.05% at 1 kHz, 600 watt output into 8-ohms
Damping Factor	57:1 @ 100 Hz	57:1 @ 100 Hz
Actual Output Impedance	0.28 ohm in series with 10 microhenries	0.14 ohm in series with 5 microhenries
Hum and Noise	96 dB signal to noise ratio	93 dB signal to noise ratio
Separation Between Any Two Model 2275's	75 dB @ 1 kHz	(Does not apply)
Phase Shift	Less than $\pm 15^\circ$ from 20 Hz to 20 kHz	Less than $\pm 20^\circ$ from 20 Hz to 20 kHz
Offset Voltage	Less than ± 50 mV DC	Less than ± 100 mV DC
Indicator	One red LED "ON" indicator per 2275 turns off in the event of module failure.	
Fuses	(2) AGC-style 2.5 amp "fast blow" fuses per 2275 Power Amplifier.	

*These specifications apply to 16-ohm operation of the Model 2275's only.

-2.0 dB (0.61V) for Model 2275 16 Ω operation or for Model 2276 8 Ω operation, -4.9 dB (0.44V) for Model 2275 8 Ω operation, or for Model 2276 4 Ω operation with appropriate attenuators at maximum CW rotation; Input Sensitivity is the same for all power amplifier operational modes.

120V AC, 50 or 60 Hz; 1100W AC line power at full power (600W) output. 1 kHz input: 660W AC line power at 1/3 power (200W) output, 1 kHz input: 360W AC line power at 1/10 power output (60W or -10 dB from full output power), pink noise input.

100, 120, 200, 220, 240V AC, 50 or 60 Hz—see Incremental Power System Operating Instructions.

(4) D3F Channel 1-4 Input Connectors. (XLR-type three-pin female.) (8) $\frac{1}{4}$ " TS Phone Jack Input Connectors (in pairs with each pair corresponding to an input channel). (4) $\frac{1}{4}$ " TRS (stereo) Phone Jack Special Input/Output connectors. (2) Eight-position terminal blocks, (one "HIGH", one "COM") corresponding to the outputs of the eight possible Model 2275 power amplifiers. (1) Three-pin (grounded) AC power cable connector. (8) 10-position card-edge connectors for up to eight Model 2275 Power Amplifiers (or up to four Model 2276 Power Amplifiers). (3) 28-position card-edge connectors for the Input, Driver and Crossover Cards.

(1) Combination AC-power-switch/circuit-breaker/pilot-lamp.

OVERALL INCREMENTAL POWER SYSTEM SPECIFICATIONS (Continued)

MODEL 2276 POWER AMPLIFIER SPECIFICATIONS

	Individual Model 2276 Driven by Model 2250 or 2252 Driver Card with Model 2220 Input Card	Four Model 2276's in Parallel/Bridge Mode Driven by Model 2250 or 2252 Driver Card with Model 2220 Input Card
Power Output	150 watts continuous average sine wave power into an 8-ohm load impedance.	600 watts continuous average sine wave power into an 8-ohm load impedance.
Power Output at Clipping	180 watts at 1 kHz into an 8-ohm load impedance	675 watts at 1 kHz into an 8-ohm load impedance
Frequency Response	+0, -0.5 dB from 20 Hz to 20 kHz	+0, -0.5 dB from 20 Hz to 20 kHz
Total Harmonic Distortion	Less than 0.25% from 20 Hz to 15 kHz Less than 0.05% at 1 kHz, 150 watt output into 8-ohms	Less than 0.25% from 20 kHz to 15 kHz Less than 0.1% at 1 kHz, 600 watt output into 8-ohms
Damping Factor	57:1 @ 100 Hz	57:1 @ 100 Hz
Actual Output Impedance	0.14 ohm in series with 5 microhenries	0.14 ohm in series with 5 microhenries
Hum and Noise	96 dB signal to noise ratio	93 dB signal to noise ratio
Separation Between Any Two Model 2276's	75 dB @ 1 kHz	(Does not apply)
Phase Shift	Less than $\pm 15^\circ$ from 20 Hz to 20 kHz	Less than $\pm 20^\circ$ from 20 Hz to 20 kHz
Offset Voltage	Less than ± 50 mV DC	Less than ± 100 mV DC
Indicator	One red LED "ON" indicator per 2276 turns off in the event of module failure.	
Fuses	(2) AGC-style 5 amp "fast blow" fuses per 2276 Power Amplifier.	

MODEL 2221 INPUT CARD SPECIFICATIONS

Type	Input Card: 4 Balanced, transformer-isolated inputs with attenuators on each input.
Attenuator Specifications	25K ohm audio-taper potentiometer with at least 60 dB attenuation at full CCW rotation.
Transformer Specifications	(Similar to Altec Model 15335A) Turns Ratio: 1:1 Impedance: 15K ohms primary and secondary Frequency Response: ± 1 dB, 20 Hz to 20 kHz Maximum Input Level: +21 dB (8.70 volts) Insertion Loss: 0.7 dB

MODEL 2250, 2250SA, 2252, AND 2252SA DRIVER MODULE SPECIFICATIONS

Type	Models 2250: Driver Card with 2 driver amplifiers, input and output switch matrix and 2 attenuators. Models 2252: Driver Card with 4 driver amplifiers, input and output switch matrix and 4 attenuators.
Driver Amplifiers	$\times 57.3$ ($35.2 \pm .2$ dB voltage amplification) amplifiers designed specifically to drive the Models 2275 and 2276 Power Amplifiers.
Switches	Matrix Switches: DIP (dual inline package) SPST switches—8-switches per DIP; 2 input DIPS and two output DIPS for Models 2250; 4 input DIPS and 4 output DIPS for Models 2252. Bridging Switches: Slide-type switch to bridge the outputs of two Model 2275 or 2275 Power Amplifiers for a 70-volt balanced output. 1 bridging switch for Models 2250, 2 bridging switches for Models 2252.

MODEL 2220 INPUT CARD SPECIFICATIONS

Type	Input Card: 4 Unbalanced inputs with attenuators on each input.
Attenuator Specifications	25K ohm audio-taper potentiometer with at least 60 dB attenuation at full CCW rotation.
Maximum Input Level	+30 dB (24.5 volts)
Input Impedance	25K ohms

Performance Specifications

Attenuators (Models 2250, 2252)

Included with Model 2275 and 2276 Power Amplifier Specifications.

One 50K ohm audio taper potentiometer at the input of each driver amplifier; at least 60 dB attenuation at full CCW rotation.

(Models 2250SA, 2252SA)

One six-position DIP switch for each attenuator with sumable steps of 1-2-4-8-16-32 dB; (maximum 63 dB attenuation); for attenuators for the Model 2252SA, two attenuators for the Model 2250SA.

bi-amplifier) to J213 ("HIGH" output): + 11.5 dB to J214 ("MID" output): -0.5 dB to J215 ("LOW" output). Note: LOW, HIGH and MID attenuators do not affect the output level at the Special Input/Output Jacks J213, J214 and J215.

MODELS 2251 and 2251SA CROSSOVER DRIVER MODULE SPECIFICATIONS

Type	2-way or 3-way electronic crossover card with 3 driver amplifiers and an output switch matrix.
Crossover Frequencies	625 Hz, 800 Hz, 1250 Hz, 1600 Hz (Low/Mid); 3150 Hz, 4000 Hz, 5000 Hz, 8000 Hz (Mid/High).
Slope Rate Frequency Response	12 dB/octave Each filter is -3 dB at the selected crossover frequency. The LOW output is less than -0.5 dB at 20 Hz; the HIGH output is less than -0.5 dB at 20 kHz. All filters are essentially flat within their respective passbands.
Phase Response	All filters conform to standard "butterworth" phase response within ± 20°
Total Harmonic Distortion	Less than 0.1% from 20 Hz to 20 kHz from any driver amplifier output, all attenuators at full CCW rotation.
Hum and Noise	95 dB Signal to Noise ratio at driver amplifier outputs with equal channel gains.
Maximum Voltage Amplification from 2220 Input to Special Input/Output Jacks J213, J214 or J215	+ 15.0 dB (+ 11.5 dB in

Minimum Load Impedance on Special Input/Output Jacks J213, J214, J215

Switches

3000 Ohms (actual output impedance is 270Q).

3 DIP (dual inline package) output bus matrix switches— 8-SPST switches per DIP; 1 "BI/TRI" switch, 2 Crossover Frequency Switches.

Driver Amplifiers

× 57.3 (35.2 ± .2 dB voltage amplification) amplifiers designed specifically to drive the Models 2275 and 2276 Power Amplifiers. 3 driver amplifiers, one each for the HIGH, MID and LOW outputs. Driver amplifiers drive the Models 2275 and 2276 Power Amplifiers but do not drive the Special Input/Output Jacks J213, J214 and J215. Mid Output may be used as a full-range channel in bi-amplifier mode with an input attenuator accessible through J214.

Attenuators Model 2251

LOW, HIGH and MID driver amplifiers have 50K ohm audio taper input attenuators with at least 60 dB attenuation at maximum CCW rotation.

Model 2251SA

LOW, MID and HIGH driver amplifiers each have a six-position DIP switch attenuator with sumable steps of 1-2-4-8-16-32 dB (maximum 63 dB attenuation).

ARCHITECT'S AND ENGINEER'S SPECIFICATIONS

The Power Amplifier system shall consist of the following modules:

1 Model 2200 Main Frame, Model 2220 Unbalanced Input Card; Model 2221 Balanced Input Card; Model 2250 2-Amplifier Driver Card; Model 2252 4-Amplifier Driver Card; Model 2251 Crossover/Driver Card; Model 2250SA 2-Amplifier Driver Card with stepped attenuators, Model 2252SA 4-Amplifier Driver Card with stepped attenuators and Model 2251SA Crossover/Driver Card with stepped attenuators. Model 2275 Power Amplifiers; Model 2276 Power Amplifiers. The following specifications shall apply to the modules:

Model 2200 Main Frame

The Main Frame shall house 1 Model 2220 or 2221 Input Card, up to 8 Model 2275 Power Amplifiers and any two of the following: Model 2250 Driver Card, Model 2252

Driver Card, Model 2251 Crossover/Driver Card. Model 2250SA 2-Amplifier Driver Card with stepped attenuators, Model 2252SA 4-Amplifier Driver Card with stepped attenuators and Model 2251SA Crossover/Driver Card with stepped attenuators. The Main Frame shall include a power supply capable of supporting a full complement of modules and capable of being operated from a 100-volt, 120-volt, 200-volt, 220-volt or 240-volt 50 or 60 Hz AC power line. The Main Frame shall include connectors for balanced or unbalanced line-level inputs and unbalanced line-level outputs and terminal blocks with ¼" "quick disconnect" terminals for power amplifier outputs. The Main Frame shall include a combination AC power-switch/circuit-breaker/ pilot-lamp and a cooling fan capable of cooling up to eight Model 2275 Power Amplifiers. The Main Frame shall be the Altec Model 2200.

ARCHITECT'S AND ENGINEER'S SPECIFICATIONS (Continued)

Model 2220 Input Card

The Input Card shall activate the four pairs of unbalanced input jacks on the Model 2200 Main Frame. The Input Card shall include a 25k-ohm audio taper potentiometer on each input with at least 60 dB of attenuation at full CCW rotation. The maximum input level with the Input Card in place shall be +30 dB (24.5 volts) and the input impedance shall be 25k-ohms. The Input Card shall be the Altec Model 2220.

Model 2221 Input Card

The Input Card shall activate the four balanced and the four pairs of unbalanced input jacks on the Model 2200 Main Frame. The Input Card shall include four isolation transformers with the following specifications: Primary and secondary impedance: 15k-ohms; Turns ratio: 1:1; Frequency Response: ± 1 dB 20 Hz to 20 kHz; Maximum Input Level: +21 dB (8.70 volts). The Input Card shall include a 25k-ohm audio taper potentiometer on each input with at least 60 dB of attenuation at full CCW rotation. The Input Card shall be the Altec Model 2221.

Model 2250 Driver Card

The Driver Card shall include two specially designed driver amplifiers, a two-by-eight input switching matrix and a two-by-eight output switching matrix. The driver amplifiers shall have a total voltage amplification of $35.2 \pm .2$ dB (x 57.3) and shall be capable of driving the inputs of the Model 2275 Power Amplifiers in the independent, parallel, bridge or parallel/bridge modes. Each driver amplifier shall include a 50k-ohm audio taper input potentiometer. A slide switch shall be provided to place the two driver amplifiers in the "bridge" mode. The input and output switching matrixes shall consist of two (each) DIP (dual-inline-package) switches with eight SPST toggle switches per DIP. Performance specifications for the driver amplifiers shall be included in the specifications for the Model 2275 or 2276 Power Amplifier. The Driver Card shall be the Altec Model 2250.

Model 2250SA Driver Card.

The Driver Card shall include two specially designed driver amplifiers, a two-by-eight input switching matrix and a two-by-eight output switching matrix. The driver amplifiers shall have a total voltage amplification of $35.2 \pm .2$ dB (x 57.3) and shall be capable of driving the inputs of the Model 2275 Power Amplifiers in the independent, parallel, bridge or parallel/bridge modes. Each driver amplifier shall include a six-position DIP switch attenuator with sumable steps of 1-2-4-8-16-32 dB. A slide switch shall be provided to place the two driver amplifiers in the "bridge" mode. The input and output switching matrixes shall consist of two (each) DIP (dual-inline-package) switches with eight SPST toggle switches per DIP. Performance specification for the driver amplifiers shall be included in the specifications for the Model 2275 or 2276 Power Amplifier. The Driver Card shall be the Altec Model 2250SA.

Model 2252 Driver Card.

The Driver Card shall include four specially designed driver amplifiers, a four-by-eight input switching matrix and a four-by-eight output switching matrix. The driver amplifiers shall have a total voltage amplification of $35.2 \pm .2$ (x 57.3) and shall be capable of driving the inputs of the Model 2275 Power Amplifiers in the independent, parallel, bridge or parallel/bridge modes. Each driver amplifier shall include a 50k-ohm audio taper input potentiometer. Two slide switches shall be provided to place each pair of driver amplifiers in the "bridge" mode. The input and

output switching matrixes shall consist of four (each) DIP (dual-inline-package) switches with eight SPST toggle switches per DIP. Performance specifications for the driver amplifiers shall be included in the specifications for the Model 2275 or 2276 Power Amplifier. The Driver Card shall be the Altec Model 2252.

Model 2252SA Driver Card

The Driver Card shall include four specially designed driver amplifiers, a four-by-eight input switching matrix and a four-by-eight output switching matrix. The driver amplifiers shall have a total voltage amplification of $35.2 \pm .2$ dB (x 57.3) and shall be capable of driving the inputs of the Model 2275 Power Amplifiers in the independent, parallel, bridge or parallel/bridge modes. Each driver amplifier shall include a six-position DIP switch, attenuator with sumable steps of 1-2-4-8-16-32 dB. Two slide switches shall be provided to place each pair of driver amplifiers in the "bridge" mode. The input and output switching matrixes shall consist of four (each) DIP (dual-inline-package) switches with eight SPST toggle switches per DIP. Performance specifications for the driver amplifiers shall be included in the specifications for the Model 2275 or 2276 Power Amplifier. The Driver Card shall be the Altec Model 2252SA.

Model 2251 Crossover/Driver Card

The Crossover/Driver Card shall be a single-channel, two-way or three-way electronic crossover specifically designed to plug into the Incremental Power System Main Frame. Switchable crossover frequencies shall be 625 Hz, 800 Hz, 1250 Hz, 1600 Hz (Low/Mid), and 3150 Hz, 4000 Hz, 5000 Hz, 8000 Hz (Mid/High). The crossover slope rate shall be 12 dB/octave. The crossover card shall include a "BI/TRI" switch for selecting two-way or three-way operation. The crossover/driver card shall include three driver amplifiers of the same type found on the Model 2250 and 2252 Driver Cards, an input attenuator for each of the HIGH, MID and LOW driver amplifier and a three-by-eight output switching matrix of the type described for the Model 2250 and 2252 Driver Cards. Pre-attenuator outputs shall be available for the HIGH, MID and LOW filters to drive the inputs of a second Incremental Power System. Performance specifications shall be as follows. Frequency Response: Essentially flat within each filter's passband, conforms to standard 2-pole Butterworth characteristics. Total Harmonic Distortion: Less than 0.1% from 20 Hz to 20 kHz from any filter output. Hum and Noise: 95 dB Signal to Noise ratio at any filter output. The crossover/driver card shall be the Altec Model 2251.

Model 2251SA Crossover/Driver Card

The crossover-driver card shall be a single-channel, two-way or three-way electronic crossover specifically designed to plug into the Incremental Power System Main Frame. Switchable crossover frequencies shall be 625 Hz, 800 Hz, 1250 Hz, 1600 Hz (Low/Mid), and 3150 Hz, 4000 Hz, 5000 Hz, 8000 Hz (Mid/High). The crossover slope rate shall be 12 dB/octave. The crossover card shall include a "BI/TRI" switch for selecting two-way or three-way operation. The crossover/driver card shall also include three driver amplifiers of the same type as found on the Model 2250SA and 2252SA Driver Cards and a three-by-eight output switching matrix of the type described for the Model 2250SA and 2252SA Driver Cards. The HIGH, MID and LOW driver amplifiers shall each include a six-position DIP switch-attenuator with sumable steps of 1-2-4-8-16-32 dB. Pre-attenuator outputs shall be available for the HIGH, MID and LOW filters to drive the inputs of a second Incremental Power System. Performance specifications shall be as follows: Frequency Response: Essen-

tially flat within each filter's passband, conforms to standard 2-pole Butterworth characteristics. Total Harmonic Distortion: Less than 0.1% from 20 Hz to 20 kHz from any filter output. Hum and Noise: 95 dB Signal to Noise ratio at any filter output. The crossover/driver card shall be the Altec Model 2251SA.

Model 2275 Power Amplifier

The power amplifier shall be specifically designed to plug into the Model 2200 Main Frame. When driven by the Incremental Power System driver amplifiers, the power amplifiers shall be capable of operation in independent mode, parallel mode, bridge mode or parallel/bridge mode. In the independent mode (single amplifiers operating independently) the power output shall be rated at 75 watts into a 16/8-ohm load. In the parallel mode (one to eight amplifiers with their inputs and outputs in parallel) the power output shall be rated at 75 watts times the number of parallel amplifiers into a load impedance equal to 16/8-ohms divided by the number of parallel amplifiers. In the bridge mode (two amplifiers receive "out-of-phase"/inverted input signals and the load is connected between their "HIGH" terminals) the rated power output shall be 150 watts into a 32/16-ohm load. In the bridge mode, the output shall be a 70/50-volt balanced output capable of driving commercial sound 70/50-volt speaker lines. In the parallel/bridge mode (two sets of two, three or four amplifiers per set with the two sets in bridge mode) the rated power output shall be 75 watts times the total number of amplifiers, and the rated load impedance shall be equal to 64/32 ohms divided by the total number of amplifiers. In the parallel/bridge mode, the output shall be a 70/50-volt balanced output capable of driving standard 70/50-volt commercial speaker lines. Performance specifications shall be as follows (specifications apply to single amplifier only). Power output: 75 watts into a 16/8-ohm load. Frequency Response: +0, -0.5 dB from 20 Hz to 20 kHz. Total Harmonic Distortion: Less than 0.25% from 20 Hz to 15 kHz. Damping factor: 57:1 @ 100 Hz. Hum and Noise: 96 dB Signal-to-Noise ratio. Rise Time: 4 microseconds. Slew rate: 8 volts/microsecond. Separation between any two amplifiers operating independently: 75 dB @ 1 kHz. Phase Shift: less than $\pm 15^\circ$ from 20 Hz to 20 kHz. Offset voltage: less than ± 30 mV DC. The power amplifier shall include a red LED "ON" indicator which shall extinguish in the event of amplifier failure. Two 2.5-amp "fast-blow" fuses shall protect the amplifier. The

power amplifier shall be the Altec Model 2275.

Model 2276 Power Amplifier

The power amplifier shall be specifically designed to plug into the Model 2200 Main Frame. When driven by the Incremental Power System driver amplifiers, the power amplifiers shall be capable of operation in independent mode, parallel mode, bridge mode or parallel/bridge mode. In the independent mode (single amplifiers operating independently) the power output shall be rated at 150 watts into an 8-ohm load. In the parallel mode (one to four amplifiers with their inputs and outputs in parallel) the power output shall be rated at 150 watts times the number of parallel amplifiers into a load impedance equal to 8 ohms divided by the number of parallel amplifiers. In the bridge mode (two amplifiers receive "out-of-phase"/inverted input signals and the load is connected between their "HIGH" terminals) the rated power output shall be 300 watts into a 16-ohm load. In the bridge mode, the output shall be a 70/50-volt balanced output capable of driving commercial sound 70/50-volt speaker lines. In the parallel/bridge mode (two sets of two amplifiers with the two sets in the bridge mode) the rated power output shall be 600 watts, and the rated load impedance shall be equal to 8 ohms. In the parallel/bridge mode, the output shall be a 70/50-volt balanced output capable of driving standard 70/50-volt commercial speaker lines. Performance specifications shall be as follows (specifications apply to single amplifier only). Power output: 150 watts into an 8-ohm load. Frequency Response: +0, -0.5 dB from 20 Hz to 20 kHz. Total Harmonic Distortion: less than 0.25% from 20 Hz to 15 kHz. Damping Factor: 57:1 @ 100 Hz. Hum and Noise: 96 dB Signal-to-Noise ratio. Rise Time: 4 microseconds. Slew Rate: 8 volts/microsecond. Separation between any two amplifiers operating independently: 75 dB @ 1 kHz. Phase Shift: less than $\pm 15^\circ$ from 20 Hz to 20 kHz. Offset voltage: less than ± 50 mV DC. The power amplifier shall include a red LED "ON" indicator which shall extinguish in the event of amplifier failure. Two 5-amp "fast-blow" fuses shall protect the amplifier. The power amplifier shall be the Altec Model 2276.

Dimensions and Weights

Dimensions and weights of the Incremental Power System Main Frame and modules shall be as given in the table on Page 7.



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