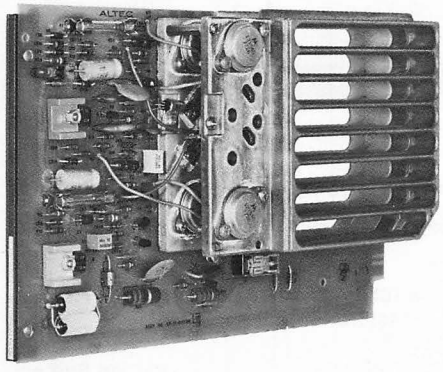
ALTEC LANSING

MODEL 2276
POWER AMPLIFIER MODULE

TECHNICAL INSTRUCTIONS



DESCRIPTION

The Model 2276 Power Amplifier Module Cards are plug-in components of the ALTEC Incremental Power System. Up to four 2276 cards may be inserted in the main frame for the desired power rating and power configuration. The Model 2276 Power Amplifier Modules are rated at 150 watts each and may be combined in 150-watt increments for up to 600 watts output power from each main frame system. Power output level and power distribution configurations may be selected to meet most audio applications.

Typical operating configurations of the Model 2276 Power Amplifier Module include:

- Independent mode for separate loudspeaker loads.
- Parallel mode to increase output power in increments of 150 watts for higher power, low impedance loads. Power available is 300, 450, or 600 watts.
- Bridged mode to drive balanced 70-volt lines. Two power amplifier modules, driven out of phase to each other, have the loudspeaker load connected to the 'hot' terminals of the two modules. Power available is 300 watts.
- Parallel-bridged mode to drive higher power, balanced 70-volt lines, or other high power loads. Two sets of parallel power amplifier modules may be bridged to obtain an output power of 600 watts.

If fewer than four Model 2276 modules are used in a main frame system, Model 2275 Power Amplifier Modules may be installed in remaining power module positions. The Models 2275 and 2276 modules may be used in independent modes, or intermixed in various combinations of parallel, bridged, or parallel-bridged modes.

SPECIFICATIONS, MODEL 2276 POWER AMPLIFIER MODULE

	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 load impedance of 8 ohms.	600 watts continuous average sine wave power into load impedance of 8 ohms
Power Output at Clipping	180 watts at 1 kHz into load impedance of 8 ohms	675 watts at 1 kHz into load impedance of 8 ohms
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 Hz 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 ±15° from 20 Hz to 20 kHz	Less than ±20° 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.	
Dimensions	6-1/2" (165.1mm) H × 2-5/8" (66.6mm) W × 10-1/8" (257.2mm) L	
Weight	2 lbs, 12 oz (1.25 Kg)	

Specifications and components subject to change without notice. Overall performance will be maintained or improved.

ALTEC LANSING
SOUND PRODUCTS DIVISION

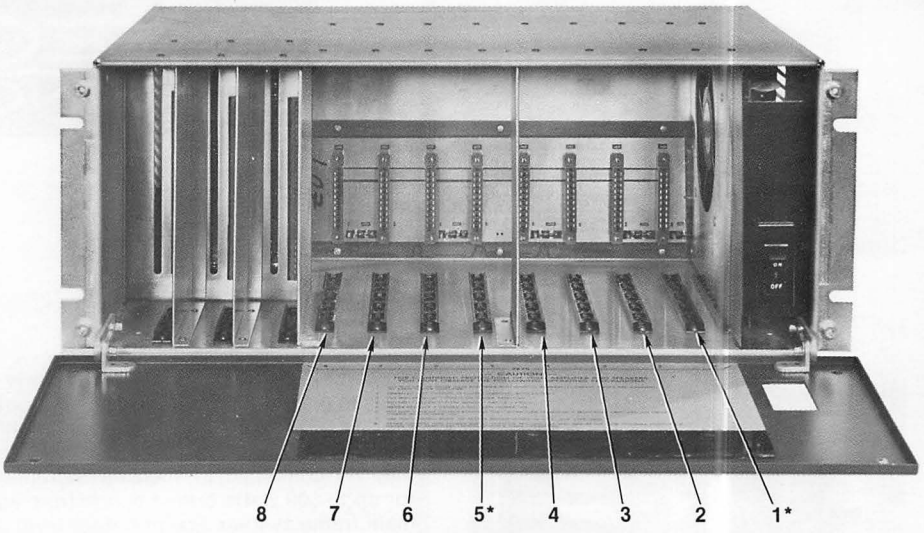
1515 S. Manchester Ave., Anaheim, Calif. 92803

42-02-045362-01
LITHO IN U.S.A. 179-1M

INSTALLATION

The Model 2276 Power Amplifier Module Cards may be installed in the amplifier bay of the main frame in positions 2, 3, 4, 6, 7, and 8. Positions 1 and 5 do not accommodate the module, because of the width of the dual heat sinks. See Figure 1. A typical installation would be to install the first 2276 module in position 2, the next module in position 4, then positions 6 and 8. Model 2275 Power Amplifier Modules may be intermixed with Model 2276 modules as desired within the main frame; however, it is recommended that any vacant amplifier module positions be located at the *farthest positions away* from the fan, for optimum cooling.

Guide channels align and support each 2276 module, which plugs into a connector at the rear of the main frame. Insert each 2276 module so that the card edges fit into the flanged portion of the top and bottom guides. Gently push the card module into the guides until it engages the rear connector. Press firmly until fully seated.



***POSITIONS 1 AND 5 DO NOT ACCOMMODATE MODEL 2276 POWER AMPLIFIER MODULES**

Figure 1. Main Frame Positions For Model 2276 Power Amplifier Modules

OUTPUT CONNECTIONS

Output connections from the power amplifier modules are made at the OUTPUT HIGH and COM terminals on the rear panel of the main frame. Figure 2 illustrates various output configurations for independent, parallel, bridged, and parallel-bridged modes of operation. Note that the voltage specifications given in Figure 2 enable calculation of power delivered to a loudspeaker system where loudspeaker load impedance is higher than the rated load impedance listed, where:

$$\text{Power (V} \times \text{A)} = (\text{Voltage})^2 \div \text{Impedance}$$

Use the Modular Block Diagram to determine all necessary input/output connections, and to determine set-up of all driver switching matrices for the desired output configuration.

70-Volt Loudspeaker Distribution System

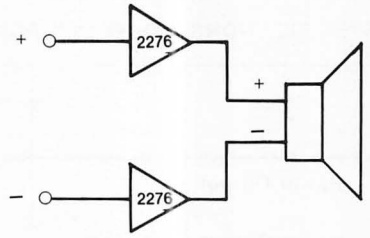
For 70-volt loudspeaker distribution systems, connect the HIGH OUTPUT terminals as described in 'Bridged Operation', and in 'Parallel/Bridged Operation'. These configurations are based on 16 ohms load impedance for the main frame.

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

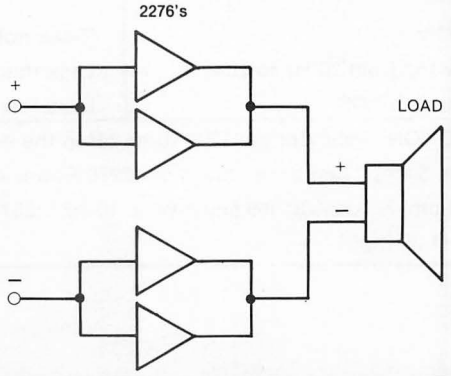


Figure 2. Power Output, Impedance and Voltage Output for Various Combinations of Model 2276 Power Amplifier Modules. Voltage specifications are based on 16 ohms load impedance for the main frame. Main frames may not be modified for 8 ohms load impedance when using the Model 2276 Power Amplifier Modules.

25-Volt Loudspeaker Distribution System

For 25-volt loudspeaker distribution systems, connect the HIGH and COM OUTPUT terminals as described in 'Independent Operation', and in 'Parallel Operation'.

Independent Operation

To operate one or more power amplifier modules independently, each module must receive a separate input signal and drive a separate loudspeaker load (Figure 3). Input signals must be routed through a driver module. No input signals may be routed from an input module directly to a power amplifier module, or from special input/output jacks J213, J214, J215, and J216 directly to a power amplifier module.

Connect the loudspeaker load to the appropriate terminals of the HIGH (TB201) and COM (TB202) OUTPUT terminal boards. Rated load impedance for a single power amplifier module in the independent mode is 8 ohms. Rated power output is 150 watts.

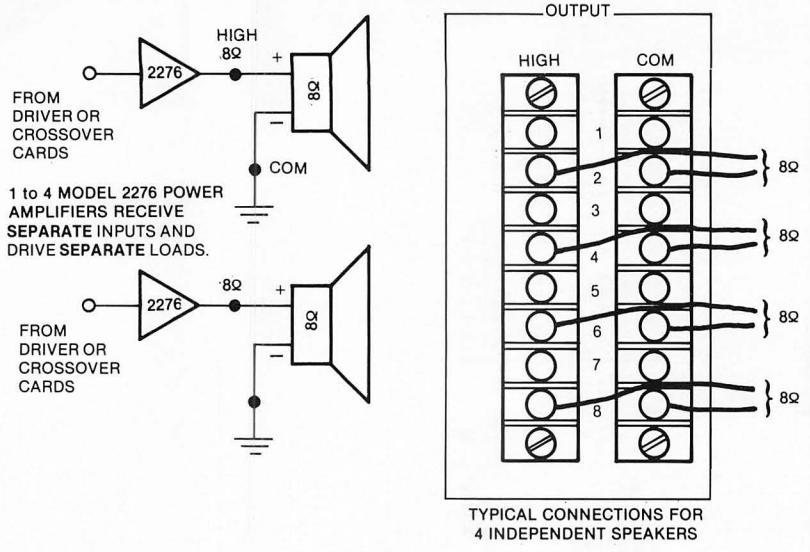


Figure 3. Typical Independent Mode of Operation

switch of the driver input switching matrix. Close bridging switch S202; this applies the input signal to the 'inverting input' of the *second driver amplifier* circuit. *Do not* assign any input signal to the normal (non-inverting) input of the second driver (amplifier circuit with the driver input switching matrix; in addition, turn the input attenuator of the second driver amplifier circuit fully counterclockwise to minimum level; for SA type driver modules, set all rocker switches to the right for maximum attenuation of 63 dB. Route the output of the first driver amplifier circuit to the input of one power amplifier module by closing the appropriate switch of the driver output switching matrix. Route the output of the second driver amplifier circuit to the input of another power amplifier module by closing the appropriate matrix switch. Connect the loudspeaker load to the HIGH OUTPUT terminals of the two power amplifier modules. *Do not* connect the loudspeaker load to the COM terminals.

Parallel Operation

Up to four Model 2276 Power Amplifier modules may be paralleled. Parallel power amplifier modules *must* receive one (common) input signal and drive one (common) loudspeaker load (Figure 4).

Route a single input signal to the power amplifier modules by closing the correct switches of the driver module switching matrix. Parallel outputs of the desired number of power amplifier modules by connecting jumper bars (supplied with the accessory kit) to the HIGH and the COM terminals.

CAUTION

If the outputs of two or more power amplifier modules are paralleled, the inputs to the same modules also must be paralleled by closing the proper switches of the driver output switching matrix. Mismatched (non-parallel) or unassigned input paths to power amplifier modules having paralleled outputs may cause fuses to blow within the modules.

Connect the loudspeaker load to the paralleled HIGH terminals and paralleled COM terminals.

Rated power output in the parallel mode is 150 watts × (number of parallel power amplifier modules). Rated load impedance is 8 ohms divided by the number of parallel power amplifier modules.

Bridged Operation

Bridged operation requires that 'out-of-phase' signals must be applied to the inputs of the two power amplifier modules to be used in this mode. The input to the first module must be inverted and applied to the second module. See Figure 5. This inversion may be accomplished with either the Model 2250 or 2252 Driver Module. The Model 2251 Crossover Driver Module may *not* be used to accomplish this inversion.

Route the input signal to the first driver amplifier circuit by closing the appropriate

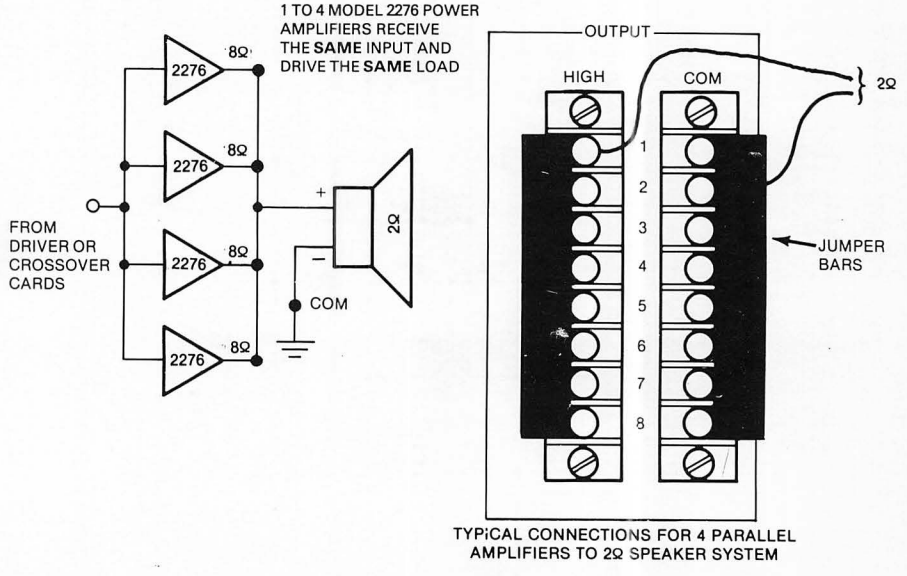


Figure 4. Typical Parallel Mode of Operation

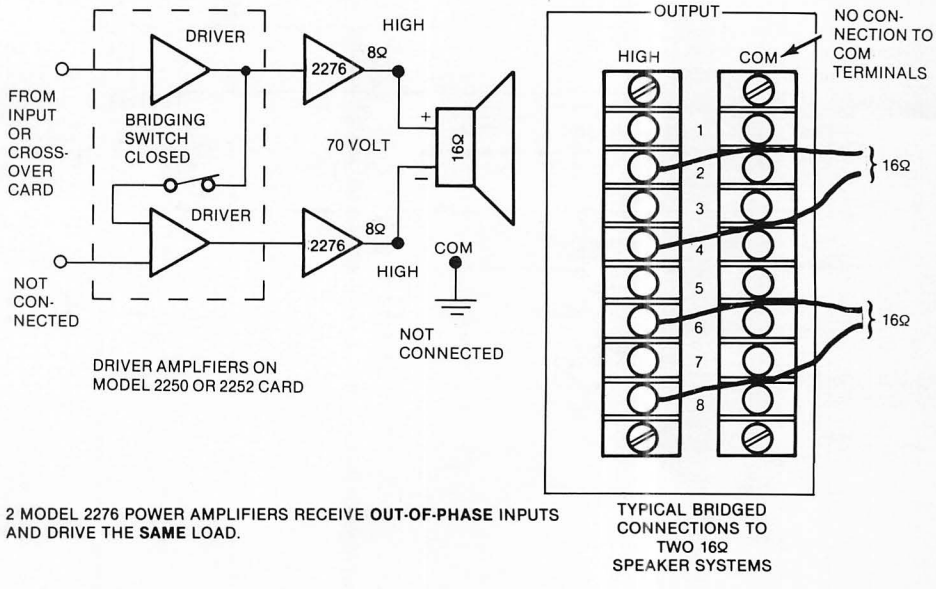


Figure 5. Typical Bridged Mode of Operation

Rated output power from two bridged power amplifier modules is 300 watts. Rated load impedance is 16 ohms. The bridged output is a 70-volt balanced (non-floating) output which may drive 70-volt commercial sound loudspeaker lines.

Parallel/Bridged Operation

The parallel/bridged mode produces a 70-volt balanced output at a higher power level than the simple bridged mode.

First parallel two identical sets of power amplifier modules as described in 'Parallel Operation'. Each set must contain the same number of paralleled power amplifier modules.

Then, bridge the two *sets* of paralleled power amplifier modules as described in 'Bridged Operation', as if each set were a single module (Figure 6).

Always bridge two sets of paralleled power amplifier modules; *do not parallel two sets of bridged power amplifier modules.*

Rated power output for the parallel/bridged mode is equal to 150 watts times the number of power amplifier modules connected into the configuration. Rated load impedance is 32 ohms divided by the number of power amplifier modules in the configuration. The parallel/bridged output is a 70-volt balanced (non-floating) output which can drive high power 70-volt commercial sound loudspeaker lines, or other high power loads.

Mixed 2275 and 2276 Power Amplifier Modules

To obtain systems with intermediate power ratings, Model 2275 Power Amplifiers may be used in combination with the dual 2276 modules. However, only the 16-ohm versions of the 2275 may be used, and *not* those modified for 8-ohm operation. Mixed 2275 and 2276 modules may be used with all four types of configurations; i.e., independent, parallel, bridged, and parallel/bridged. For bridged and parallel/bridged configurations, each side of the bridge *must have identical sets of mixed modules.*

ADJUSTMENTS

In the event of replacement of circuit components, the bias and offset should be checked and reset prior to using the power amplifier module. Use of the Model 2279 Extender Card will facilitate this voltage measurement and readjustment.

Bias Adjustment

1. Disconnect load at appropriate OUTPUT terminals at rear of main frame.
2. Check for voltage of 0.010 to 0.020V dc across resistor R22. See Figure 7. As necessary, adjust Bias Control R13.

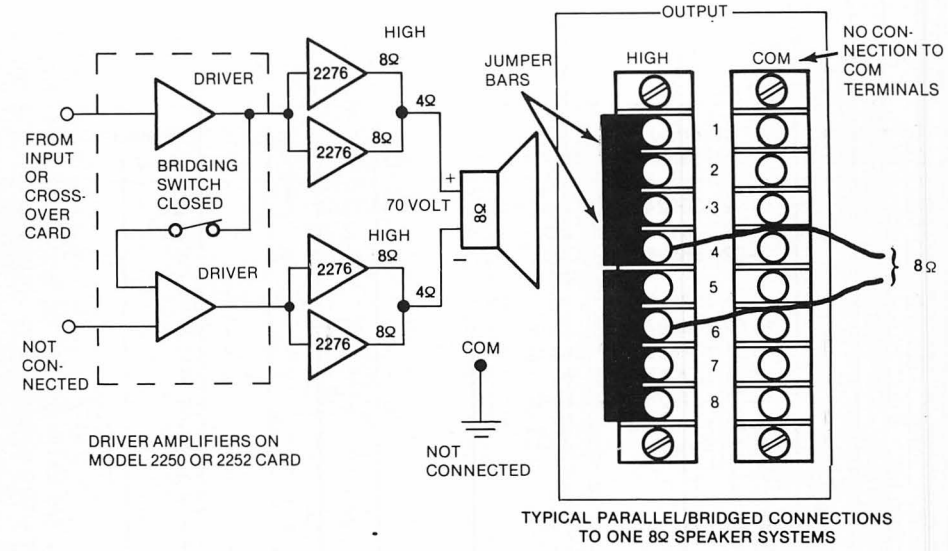


Figure 6. Typical Parallel/Bridged Mode of Operation

3. Operate system without signal for two minutes and repeat Steps 1 and 2.
4. Reconnect load at OUTPUT terminals.

Offset Adjustment

1. Check that appropriate driver is assigned (appropriate matrix switches closed) to power amplifier module.
2. With input signal (to input module) at zero, check for voltage of less than ± 30 mV dc at appropriate OUTPUT terminals at rear of main frame. As necessary, adjust Offset Control R3. See Figure 7.
3. Operate system without signal for two minutes and repeat Steps 1 and 2.
4. Resume normal operation.

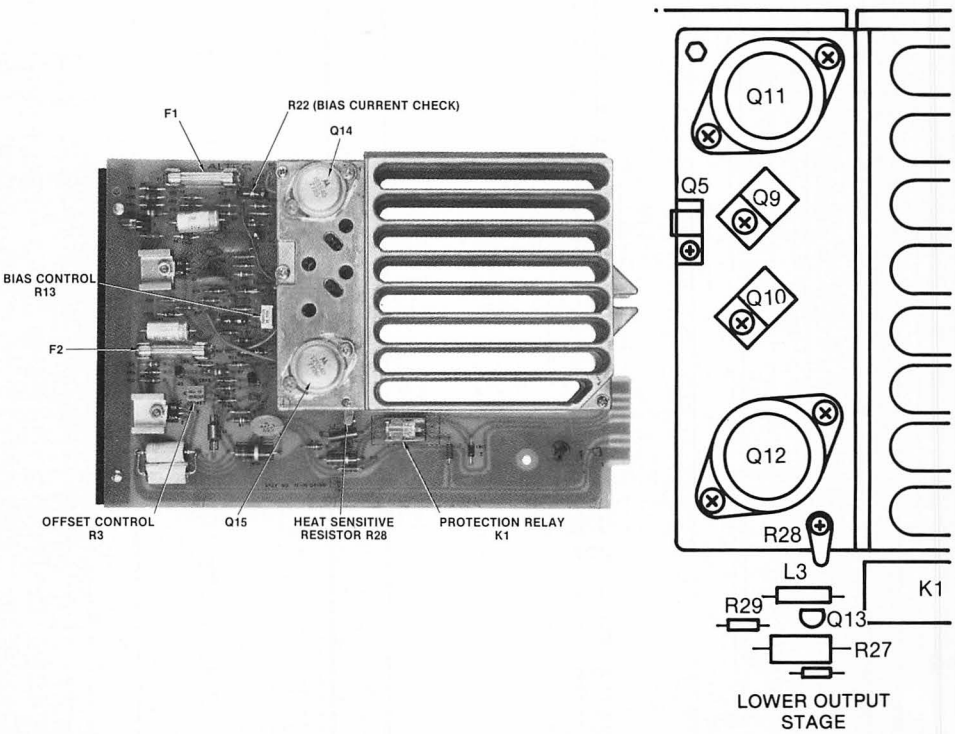
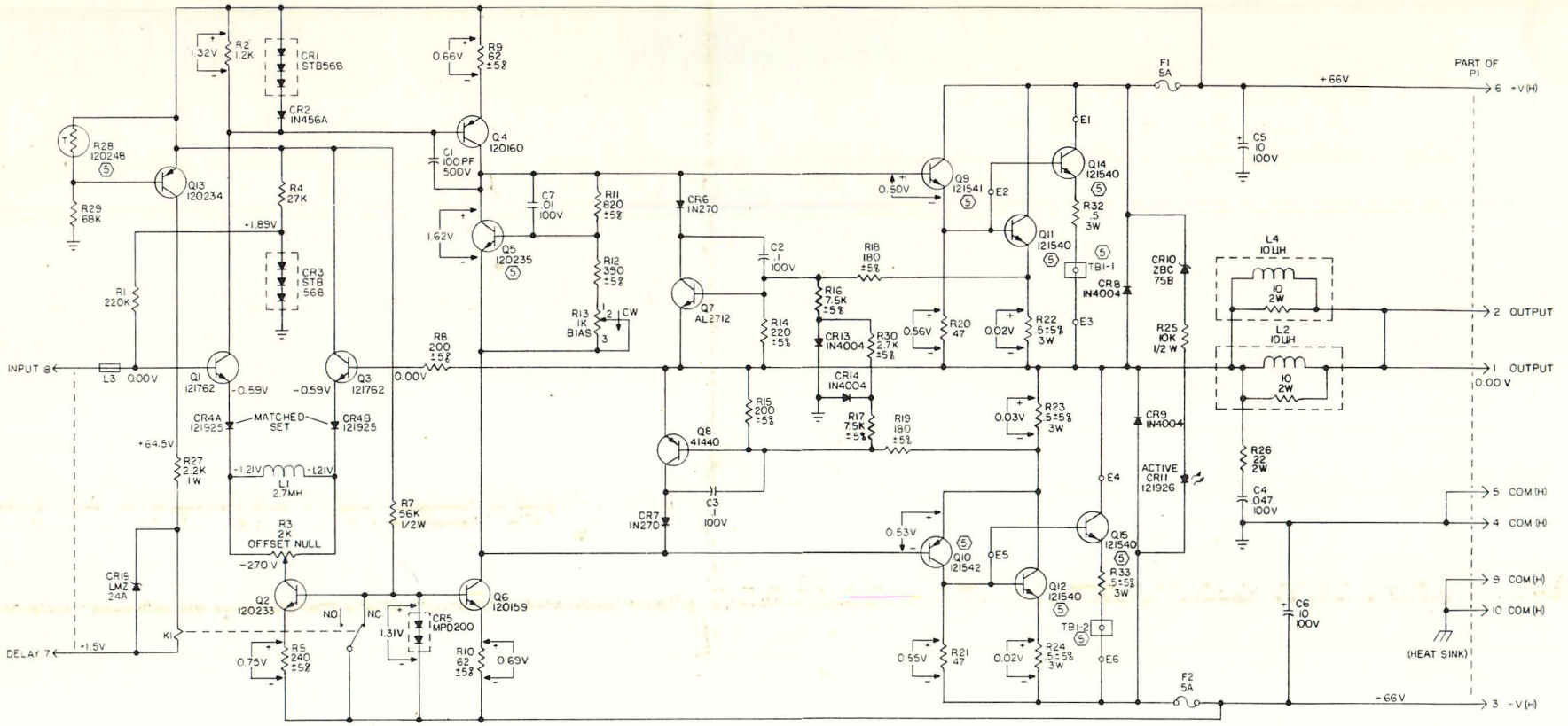


Figure 7. Components of Model 2276 Power Amplifier Module

Reference Designator	Ordering Number	Name and Description
C1	15-02-100024-02	Cap., 100 pF ± 10%, 500V
C2, 3	15-02-100109-01	Cap., 0.1 mF ± 20%, 100V
C4	15-02-108526-02	Cap., 0.47 mF + 80%, − 20% 100V
C5, 6	15-01-102595-01	Cap., 10 mF, 100V
C7	15-02-100307-01	Cap., 0.1 mF ± 20%, 100V
CR1, 3	48-01-107429-02	Diode, STB 568, 12V
CR2	48-01-107017-01	Diode, 1N456A
CR4A, 4B	48-01-121925-01	Diode, matched set, 121925
CR5	48-01-121865-01	Diode, MPD200
CR6, 7	48-01-100876-01	Diode, 1N270
CR8, 9, 13, 14	48-02-042787-01	Rect., 42787
CR10	48-01-114356-01	Diode, Zener, 75V ± 5%, 2W
CR11	39-01-121926-01	Lamp, LED, red
CR15	48-01-107522-01	Diode, Zener, 24V ± 5%, 2W
F1, 2	51-04-100466-01	Fuse, 2.5A, 250V, 3AG
K1	45-01-079458-01	Relay, 8A507
L1	56-01-121543-01	Choke, RF, 2.7 mH
L2, 4	56-01-018220-01	Choke, 10 μH
L3	56-01-043100-01	Choke, ferrite bead, 6D462
Q1, 3	48-03-121762-01	Transistor, MPS-A 43, selected
Q2	48-03-120233-01	Transistor, SPS 6872K, MPS A43
Q4	48-03-120160-02	Transistor, MPS-U60, selected
Q5	48-03-120235-02	Transistor, 120235
Q6	48-03-120159-02	Transistor, 120159
Q7	48-03-101098-04	Transistor, 2N2711, selected
Q8	48-03-041440-03	Transistor, 2N3906, selected

Reference Designator	Ordering Number	Name and Description
Q9	48-03-121541-01	Transistor, 121541
Q10	48-03-121542-01	Transistor, 121540
Q11, 12, 14, 15	48-03-121540-01	Transistor, SJ6333, selected
Q13	48-03-120234-02	Transistor, MPS-A93
R1	47-02-102191-01	Res., 220 kΩ ± 10%, 1/4W
R2	47-01-102164-01	Res., 1.2 kΩ ± 10%, 1/4W
R3	47-06-121916-01	Pot., 2 kΩ ± 20%, 1/2W
R4	47-01-102180-01	Res., 27 kΩ ± 10%, 1/4W
R5	47-01-102063-01	Res., 240 Ω ± 5%, 1/4W
R7	47-01-102376-01	Res., 56 kΩ ± 10%, 1/4W
R8, 15	47-01-102061-01	Res., 200Ω ± 5%, 1/4W
R9, 10	47-01-102049-01	Res., 62 Ω ± 5%, 1/4W
R11	47-01-102076-01	Res., 820 Ω ± 5%, 1/4W
R12	47-01-102068-01	Res., 390 Ω ± 5%, 1/4W
R13	47-06-121743-01	Pot., 1 kΩ ± 20%, 1/2W
R14	47-01-102062-01	Res., 220 Ω ± 5%, 1/4W
R16, 17	47-01-102099-01	Res., 7.5 kΩ ± 5%, 1/4W
R18, 19	47-01-102060-01	Res., 180 Ω ± 5%, 1/4W
R20, 21	47-01-102147-01	Res., 47 Ω ± 10%, 1/4W
R22, 23, 24, 32, 33	47-02-120244-01	Res., 0.5 Ω ± 5%, 3W
R25	47-01-102376-01	Res., 10 kΩ ± 10%, 1/2W
R26	47-01-102627-01	Res., 22 Ω ± 10%, 2W
R27	47-01-100653-01	Res., 2.2 kΩ ± 10%, 1W
R28	47-02-120248-01	Res., temp. var., 120248
R29	47-01-102185-01	Res., 68 kΩ ± 10%, 1/4W
R30	47-01-102088-01	Res., 2.7 kΩ ± 5%, 1/4W



6. D.C. VOLTAGES NOMINAL AT QUIESCENT, HEATSINK AT 26°C WITH 10 MIN WARMUP. VOLTAGES REFERENCED TO COM (H). UNLESS OTHERWISE DESIGNATED MODULE IN TEST FIXTURE AT 24° C AMBIENT, STILL AIR, INPUT SHORTED TO COM(H).

(5) COMPONENT MOUNTED ON HEATSINK.

4 FOR ASSY DWG SEE 9D579.

3 FOR SEPARATE BILL OF MATERIAL SEE 10-02-01-217 AND 27-01-045354.

2 ALL CAPACITORS VALUES ARE GIVEN IN MICROFARADS.

1 ALL RESISTORS ARE IN OHMS 1/4 W ±10%

NOTES: UNLESS OTHERWISE SPECIFIED

HIGHEST REFERENCE DESIGNATION USED			
Q15	CR15	R33	C7
L4	K1	F2	E6
REFERENCE DESIGNATIONS NOT USED			
CR12	R31	R6	

Figure 8. Schematic (9D580-01), Model 2276 Power Amplifier Module