



POWER AMPLIFIER SERVICE MANUAL

COM-TECH[®] 200

Model CT200B

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The information furnished in this manual does not include all of the details of design, production, or variations of the equipment. Nor does it cover every possible situation which may arise during installation, operation or maintenance. If you need special assistance beyond the scope of this manual, please contact the Crown Technical Support Group.

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CAUTION

TO PREVENT ELECTRIC SHOCK DO NOT REMOVE TOP OR BOTTOM COVERS. NO USER SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL. DISCONNECT POWER CORD BEFORE REMOVING REAR INPUT MODULE TO ACCESS GAIN SWITCH.

AVIS

À PRÉVENIR LE CHOC ÉLECTRIQUE N'ENLEVEZ PAS LES COUVERTURES. RIEN DES PARTIES UTILES À L'INTÉRIEUR. DÉBRANCHER LA BORNE AVANT D'OUVRIER LA MODULE EN ARRIÈRE.

WARNING

TO REDUCE THE RISK OF ELECTRIC SHOCK, DO NOT EXPOSE THIS EQUIPMENT TO RAIN OR MOISTURE!

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Introduction

This manual contains service information on Crown power amplifiers. It is designed to be used in conjunction with the applicable Owner's Manual. However, some important information is duplicated in this Service Manual in case the Owner's Manual is not readily available.

NOTE: THE INFORMATION IN THIS MANUAL IS INTENDED FOR USE BY AN EXPERIENCED TECHNICIAN ONLY!

Scope

This Service Manual is intended to apply to all versions of the CT-200B amplifier including the Amcron version. The Parts Listings include parts specific for the US version and the European version (CT-200BE13). For parts specific only to other versions contact the Crown Technical Support Group for help in finding part numbers.

This Service Manual includes several sections. These sections include Parts Information, Specifications, Voltage Conversion, Circuit Theory, Electrical Test Procedures, Non-Module Parts Lists, and Module Parts Lists. Schematics are attached. Note that component parts with circuit board comprise a complete module. Module part numbers are always associated with a specific circuit board, although an unpopulated circuit

board may be built up with different parts to create different modules. Note that Crown does not sell blank (unpopulated) circuit boards.

Each of the compact audio power amplifiers are designed for professional or commercial use. Providing high power amplification from 20Hz to 20KHz with minimum distortion, they feature balanced inputs with bridged and parallel monophonic capability. Specific features vary depending on model family.

Warranty

Each Owner's Manual contains basic policies as related to the customer. In addition it should be stated that this service documentation is meant to be used only by properly trained service personnel. Because most Crown products carry a 3 Year Full Warranty (including round trip shipping within the United States), all warranty service should be referred to the Crown Factory or Authorized Warranty Service Center. See the applicable Owner's Manual for warranty details. To find the location of the nearest Authorized Service Center or obtain instructions for receiving Crown Factory Service please contact the Crown Technical Support Group (within North America) or your Crown/Amcron Importer (outside North America).

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Parts Information

General Information

Later sections include both mechanical and electrical parts lists for this product. The parts listed are current as of the date printed. Crown reserves the right to modify and improve its products for the benefit of its customers.

Part Numbering System

As of the printing of this manual, Crown is using two numbering systems. The elder system always uses eight characters. The first character is a letter. Common letters used are C, D, H, M, P, and Q. The second through sixth characters are numbers. The numbers build sequentially (for each prefix letter) as new parts are added to our parts inventory system. (In some cases there will be a space then a four character number after the prefix letter; the space is considered a character.) The seventh character is usually a hyphen, though it may be a letter to indicate a revision or special note. The last character is called a check-digit, and is useful to Crown for internal tracking.

Crown is in the process of converting to a new part number system. Length may vary from eight to twelve characters. There is still a letter prefix, then five numbers. These five numbers identify a type of part. The seventh character is a hyphen. Remaining characters identify the details of the type of part identified by the first part of the number.

Standard and Special Parts

Many smaller electrical and electronic parts used by Crown are stocked by and available from electronic supply houses. However, some electronic parts that appear to be standard are actually special. A part ordered from Crown will assure an acceptable replacement. Structural items such as modules and panels are available from Crown only.

Ordering Parts

When ordering parts, be sure to give the product model, and include a description and part number (CPN/DPN) from the parts listing. Price quotes are available on request.

Shipment

Shipment will be normally made by UPS or best other method unless you specify otherwise. Shipments are made to and from Elkhart, Indiana USA, only. Established accounts with Crown will receive shipment freight prepaid and will be billed. All others will receive ship-

ment on a C.O.D. or pre-payment (check or credit card) basis.

Terms

Normal terms are pre-paid. Net-30 Days applies to only those firms having pre-established accounts with Crown. If pre-paying, the order must be packed and weighed before a total bill can be established, after which an amount due will be issued and shipment made upon receipt of pre-payment. New parts returned for credit are subject to a 10% re-stocking fee, and authorization from the Crown Parts Department must be obtained before returning parts for credit.

Crown is not a general parts warehouse. Parts sold by the Crown Parts Department are solely for servicing Crown/Amcron products. **Part prices and availability are subject to change without notice.**

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Specifications

Unless noted otherwise, all specifications are based on driving an 8 ohm load per channel, both channels driven, the sensitivity switch in the 26dB position, the AC supply is 120VAC at 60Hz. Crown specifications are guaranteed through the warranty period (normally 3 years). Because our testing methods are more stringent than our published specifications, every Crown amplifier will exceed its published specifications.

Power

Power

8 Ohm Stereo—110W/Ch
 4 Ohm Stereo—150W/Ch
 70-V Line Stereo—105W/Ch
 8 Ohm Bridge Mono—295W
 4 Ohm Parallel Mono—225W
 2 Ohm Parallel Mono—300W
 Bridge Mono, 140-V Line—210W
 Parallel Mono, 70-V Line—210W

Load Impedances: Rated for 16, 8, 4, 2, Ohm, and 70-V use. Safe with all types of loads, even totally reactive loads.

AC Mains: 120VAC at 60 Hz with standard three-wire grounded connector for North American units; 100VAC, 120VAC, 220VAC, and 240VAC at 50 or 60 Hz units are available when ordered country specific. Com-Tech amplifiers are not voltage convertible.

Performance

Frequency Response: ± 0.1 dB from 20 Hz to 20 kHz at 1 Watt.

Phase Response: $\pm 10^\circ$ from 10 Hz to 20 kHz at 1 Watt.

Signal to Noise Ratio: A-weighted, better than 105 dB below full rated output. Better than 100 dB below full rated output from 20 Hz to 20 kHz.

Total Harmonic Distortion (THD): $< 0.05\%$ from 20 Hz to 1 kHz, increasing linearly to 0.1% at 20 kHz at 500W.

I.M. Distortion: $< 0.05\%$ from less than 164 milliwatts to 520 W at 26 dB gain.

Slew Rate: > 13 V per microsecond. (Slew rates are limited to useful levels for ultrasonic/RF protection.)

Damping Factor: > 1000 from 10 Hz to 400 Hz.

DC Offset: < 10 millivolts.

Input Impedance: Nominally 20K ohms balanced; 10K ohms unbalanced.

Output Impedance: < 10 milliohms in series with < 2 microhenries.

Protection Systems: Output Device Emulation Protection (ODEP) limits drive in the event of dangerous dynamic thermal conditions without interrupting power. Current limiting for shorted load protection. DC/LF and common mode output current Fault circuitry to mute audio. Delay of 4 seconds from turn on mutes amplifier to prevent dangerous turn-on transients.

Mechanical

Input Connectors: Balanced three-terminal barrier block for each channel on standard P.I.P.-BB module (included)

Output Connectors: Four-terminal barrier block.

Front Panel Controls: A front panel rocker switch used to power the amplifier on and off.

Back Panel Controls: A three-position switch which selects Stereo, Bridge-Mono, or Parallel-Mono mode. A rotary potentiometer for each channel used to control output level. A two position recessed switch for each channel selects between 8/4 ohm and 70-V modes. A push button circuit breaker used to protect the power supply.

Internal Controls: A three-position switch selects 0.775V, 1.4V, or 26 dB voltage gain input sensitivity.

Indicators: Amber Enable indicator shows on/off status of low-voltage power supply. A green indicator for each channel shows the reserve energy status. If no reserve energy is available the indicator will dim in proportion to ODEP limiting. A yellow indicator for each channel flashes in the event of distortion. And green SPI (signal presence indicator) indicators show the presence of output signal.

Construction: Black splatter-coat steel chassis with specially designed flow-through ventilation system.

Mounting: Standard EIA 310 front-panel rack mount with supports for supplemental rear corner mounting.

Dimensions: 19 inches wide, 3.5 inches high, 16 inches deep behind front mounting surface.

Weight: 29 lbs, 6.5 oz.

Theory

Overview

It should be noted that over time Crown makes improvements and changes to their products for various reasons. This manual is up to date as of the time of writing. For additional information regarding these amplifiers, refer to the applicable Technical Notes provided by Crown for this product.

This section of the manual explains the general operation of a typical Crown power amplifier. Topics covered include Front End, Grounded Bridge, and ODEP. Due to variations in design from vintage to vintage (and similarities with other Crown products) the theory of operation remains simplified.

Features

Com-Tech amplifiers utilize numerous Crown innovations including grounded bridge and ODEP technologies. Cooling techniques make use of the what is essentially air conditioner technology. Air flows bottom to top, and front to side. Air flows a short distance across a wide heatsink. This type of air flow provides significantly better cooling than the "wind tunnel" technology used by many other manufacturers. Output transistors are of the metal can type rather than plastic case. This allows for a significantly higher thermal margin for the given voltage and current ratings. All devices used are tested and graded to ensure maximum reliability. Another electronic technique used is negative feedback. Almost all power amplifiers utilize negative feedback to control gain and provide stability, but Crown uses multiple nested feedback loops for maximum stability and greatly improved damping. Most Crown amplifiers have damping in excess of 1000 in the bass frequency range. This feedback, along with our compensation and ultra-low distortion output topology, make Crown amplifiers superior.

Features specific to the Com-Tech Series' include slew rate limiting, and audio muting for delay or protective action. This amplifier can operate in either a Bridged or Parallel Mono mode as well as dual (stereo). A sensitivity switch allows selection of input voltage required for rated output. Level controls are mounted on the rear panel and are of the rotary type. Front panel indicators let the user know the status of the low voltage power supply (enable), signal presence, distortion, and an ODEP indicator for each channel which shows the reserve energy status. In general, the packaging of this model is designed for maximum watt/price/weight/size value with user friendly features.

For additional details refer to the specification section, or to the applicable Owner's Manual.

Front End Operation

The front end is comprised of three stages: Balanced Gain Stage (BGS), Variable Gain Stage (VGS), and the Error Amp. Figure 1 shows a simplified diagram of a typical front end with voltage amplification stages.

Balanced Gain Stage (BGS)

Input to the amplifier is balanced. The shield may be isolated from chassis ground by an RC network to interrupt ground loops via the Ground Lift Switch. The non-inverting (hot) side of the balanced input is fed to the non-inverting input of the first op-amp stage. The inverting (negative) side of the balanced input is fed to the inverting input of the first op-amp stage. A potentiometer is provided for common mode rejection adjustment. Electrically, the BGS is at unity gain. (From an audio perspective, however, this stage actually provides +6dB gain if a fully balanced signal is placed on its input.) The BGS is a non-inverting stage. It's output is delivered to the Variable Gain Stage.

Variable Gain Stage (VGS)

From the output of the BGS, the signal goes to the VGS where gain is determined by the position of the Sensitivity Switch, and level is determined by the level control. VGS is an inverting stage with the input being fed to its op-amp stage. Because gain after this stage is fixed at 26dB (factor of 20), greater amplifier sensitivity is achieved by controlling the ratio of feedback to input resistance. The Sensitivity Switch sets the input impedance to this stage and varies the gain such that the overall amplifier gain is 26 dB, or is adjusted appropriately for 0.775V or 1.4V input to attain rated output.

Error Amp

The inverted output from the VGS is fed to the non-inverting input of the Error Amp op-amp stage through an AC coupling capacitor and input resistor. Amplifier output is fed back via the negative feedback (NFb) loop resistor. The ratio of feedback resistor to input resistor fixes gain from the Error Amp input to the output of the amplifier at 26 dB. Diodes prevent overdriving the Error Amp. Because the Error Amp amplifies the difference between input and output signals, any difference in the two waveforms will produce a near open loop gain condition which in turn results in high peak output voltage. The output of the Error Amp, called the Error Signal (ES) drives the Voltage Translators.

Theory

Voltage Amplification

The Voltage Translator stage separates the output of the Error Amp into balanced positive and negative drive voltages for the Last Voltage Amplifiers (LVAs), translating the signal from ground referenced $\pm 15V$ to $\pm V_{CC}$ reference. LVAs provide the main voltage amplification and drive the High Side output stages. Gain from Voltage Translator input to amplifier output is a factor of 25.2.

Voltage Translators

A voltage divider network splits the Error Signal (ES) into positive and negative drive signals for the balanced voltage translator stage. These offset reference voltages drive the input to the Voltage Translator transistors. A nested NFB loop from the output of the amplifier mixes with the inverted signal riding on the offset references. This negative feedback fixes gain at the offset reference points (and the output of the Error Amp) at a factor of -25.2 with respect to the amplifier output. The Voltage Translators are arranged in a common base configuration for non-inverting voltage gain with equal gain. They shift the audio from the $\pm 15V$ reference to V_{CC} reference. Their outputs drive their respective LVA.

Also tied into the Voltage Translator inputs are ODEP limiting transistors and control/protection transistors. The ODEP transistors steal drive as dictated by the ODEP circuitry (discussed later). The control/protection transistors act as switches to totally shunt audio to ground during the turn-on delay, or during a DC/LF or Fault protective action.

Last Voltage Amplifiers (LVAs)

The Voltage Translator stage channels the signal to the Last Voltage Amplifiers (LVA's) in a balanced configuration. The +LVA and -LVA, with their push-pull effect through the Bias Servo, drive the fully complementary output stage. The LVAs are configured as common emitter amplifiers. This configuration provides sufficient voltage gain and inverts the audio. The polarity inversion is necessary to avoid an overall polarity inversion from input jack to output jack, and it allows the NFB loop to control Error Amp gain by feeding back to its non-inverting input (with its polarity opposite to the output of the VGS). With the added voltage swing provided by the LVAs, the signal then gains current amplification through the Darlingtong emitter-follower output stage.

Grounded Bridge Topology

Figure 2 is a simplified example of the grounded bridge output topology. It consists of four quadrants of three deep Darlington (composite) emitter-follower stages per channel: one NPN and one PNP on the High Side of the bridge (driving the load), and one NPN and one PNP on the Low Side of the bridge (controlling the ground reference for the rails). The output stages are biased to operate class AB+B for ultra low distortion in the signal zero-crossing region and high efficiency.

High Side (HS)

The High Side (HS) of the bridge operates much like a conventional bipolar push-pull output configuration. As the input drive voltage becomes more positive, the HS NPN conducts and delivers positive voltage to the load. Eventually the NPN devices reach full conduction and $+V_{CC}$ is across the load. At this time the HS PNP is

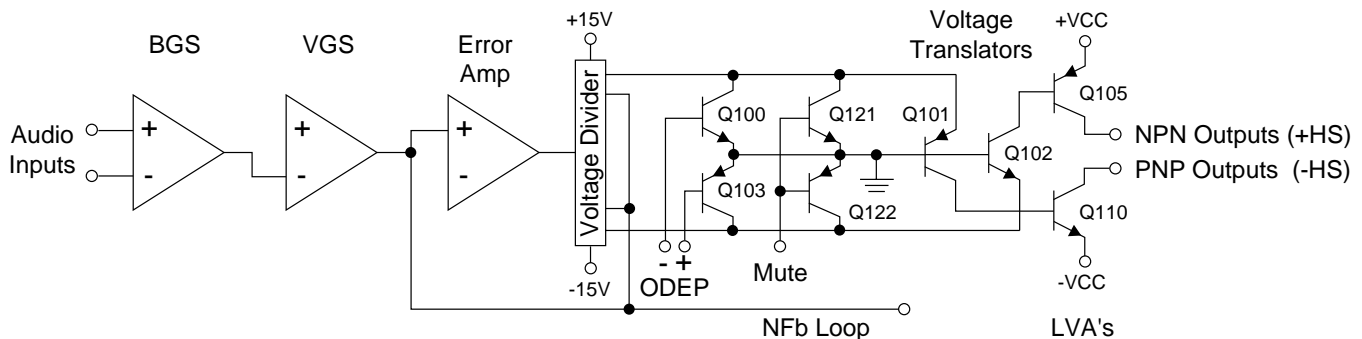


Figure 1. Typical Amplifier Front End and Voltage Amplification Stages.

Theory

biased off. When the drive signal is negative going, the HS PNP conducts to deliver $-V_{cc}$ to the load and the HS NPN stage is off.

The output of the +LVA drives the base of predriver device. Together, the predriver and driver form the first two parts of the three-deep Darlington and are biased class AB. They provide output drive through the bias resistor, bypassing the output devices, at levels below about 100mW. An RLC network between the predriver and driver provide phase shift compensation and limit driver base current to safe levels. Output devices are biased class B, just below cutoff. At about 100mW output they switch on to conduct high current to the load. Together with predriver and driver, the output device provide an overall class AB+B output.

The negative half of the HS is almost identical to the positive half, except that the devices are PNP. One difference is that the PNP bias resistor is slightly greater in value so that PNP output devices run closer to the cutoff level under static (no signal) conditions. This is because PNP devices require greater drive current.

HS bias is regulated by Q18, the Bias Servo. Q18 is a V_{be} multiplier which maintains approximately 3.3V V_{ce} under static conditions. The positive and negative halves of the HS output are in parallel with this 3.3V. With a full base-emitter on voltage drop across

predrivers and drivers, the balance of voltage results in approximately .35V drop across the bias resistors in the positive half, and about .5V across the bias resistor in the negative half. Q18 conduction (and thus bias) is adjustable.

A diode string prevents excessive charge build up within the high conduction output devices when off. Flyback diodes shunt back-EMF pulses from reactive loads to the power supply to protect output devices from dangerous reverse voltage levels. An output terminating circuit blocks RF on output lines from entering the amplifier through its output connectors.

Low Side (LS)

The Low Side (LS) operates quite differently. The power supply bridge rectifier is not ground referenced, nor is the secondary of the main transformer. In other words, the high voltage power supply floats with respect to ground, but $\pm V_{cc}$ remain constant with respect to each other. This allows the power supply to deliver $+V_{cc}$ and $-V_{cc}$ from the same bridge rectifier and filter as a total difference in potential, regardless of their voltages with respect to ground. The LS uses inverted feedback from the HS output to control the ground reference for the rails ($\pm V_{cc}$). Both LS quadrants are arranged in a three-deep Darlington and are biased AB+B in the same manner as the HS.

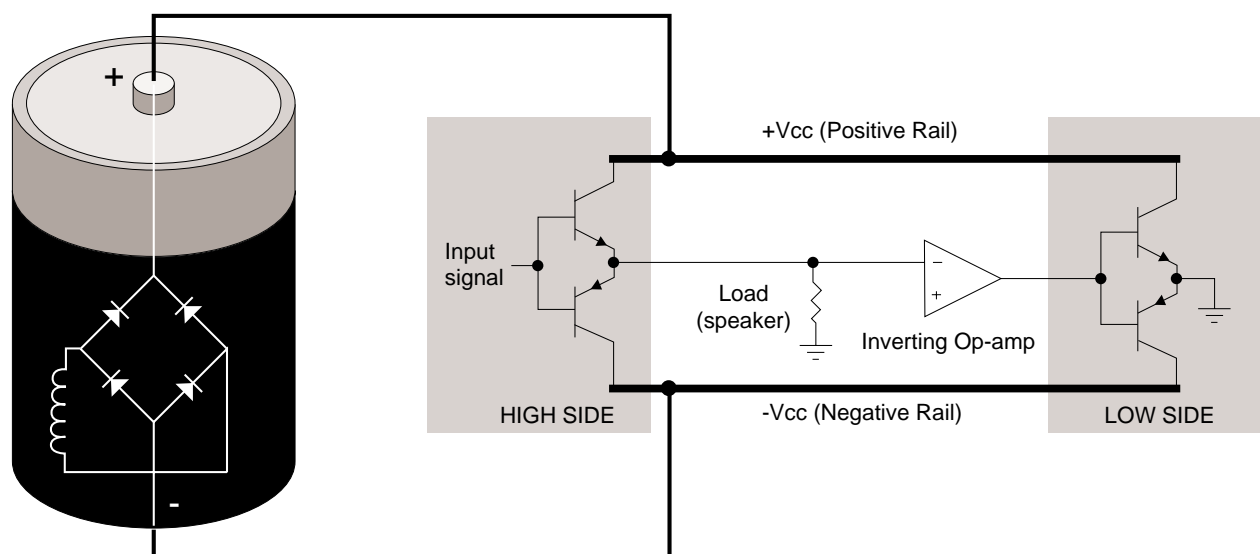


Figure 2. Crown Patented Grounded Bridge Topology

Theory

When the amplifier output swings positive, the audio is fed to an op-amp stage where it is inverted. This inverted signal is delivered directly to the bases of the positive (NPN) and negative (PNP) LS predrivers. The negative drive forces the LS PNP devices on (NPN off). As the PNP devices conduct, V_{ce} of the PNP Darlington drops. With LS device emitters tied to ground, $-V_{cc}$ is pulled toward ground reference. Since the power supply is not ground referenced (and the total voltage from $+V_{cc}$ to $-V_{cc}$ is constant) $+V_{cc}$ is forced higher above ground potential. This continues until, at the positive amplifier output peak, $-V_{cc} = 0V$ and $+V_{cc}$ equals the total power supply potential with a positive polarity. If, for example, the power supply produced a total of 70V from rail to rail ($\pm 35V_{DC}$ measured from ground with no signal), the amplifier output would reach a positive peak of +70V.

Conversely, during a negative swing of the HS output where HS PNP devices conduct, the op-amp would output a positive voltage forcing LS NPN devices to conduct. This would result in $+V_{cc}$ swinging toward ground potential and $-V_{cc}$ further from ground potential. At the negative amplifier output peak, $+V_{cc} = 0V$ and $-V_{cc}$ equals the total power supply potential with a negative polarity. Using the same example as above, a 70V supply would allow a negative output peak of -70V. In summary, a power supply which produces a total of 70VDC rail to rail (or $\pm 35V_{DC}$ statically) is capable of producing 140V peak-to-peak at the amplifier output when the grounded bridge topology is used. The voltage used in this example are relatively close to the voltages of the PB-1/460CSL.

The total effect is to deliver a peak to peak voltage to the speaker load which is twice the voltage produced by the power supply. Benefits include full utilization of the power supply (it conducts current during both halves of the output signal; conventional designs require two power supplies per channel, one positive and one negative), and never exposing any output device to more than half of the peak to peak output voltage (which does occur in conventional designs).

Low side bias is established by a diode string which also shunts built up charges on the output devices. Bias is adjustable via potentiometer. Flyback diodes perform the same function as the HS flybacks. The output of the LS is tied directly to chassis ground via ground strap.

Output Device Emulation Protection (ODEP)

To further protect the output stages, a specially developed ODEP circuit is used. It produces a complex analog output signal. This signal is proportional to the always changing safe-operating-area margin of the output transistors. The ODEP signal controls the Voltage Translator stage by removing drive that may exceed the safe-operating-area of the output stage.

ODEP senses output current by measuring the voltage dropped across LS emitter resistors. LS NPN current (negative amplifier output) and $+V_{cc}$ are sensed, then multiplied to obtain a signal proportional to output power. Positive and negative ODEP voltages are adjustable via two potentiometers. Across \pm ODEP are a PTC and a thermal sense (current source). The PTC is essentially a cutoff switch that causes hard ODEP limiting if heatsink temperature exceeds a safe maximum, regardless of signal level. The thermal sense causes the differential between +ODEP and -ODEP to decrease as heatsink temperature increases. An increase in positive output signal output into a load will result in -ODEP voltage dropping; an increase in negative output voltage and current will cause +ODEP voltage to drop. A complex RC network between the \pm ODEP circuitry is used to simulate the thermal barriers between the interior of the output device die (immeasurable by normal means) and the time delay from heat generation at the die until heat dissipates to the thermal sensor. The combined effects of thermal history and instantaneous dynamic power level result in an accurate simulation of the actual thermal condition of the output transistors.

Theory

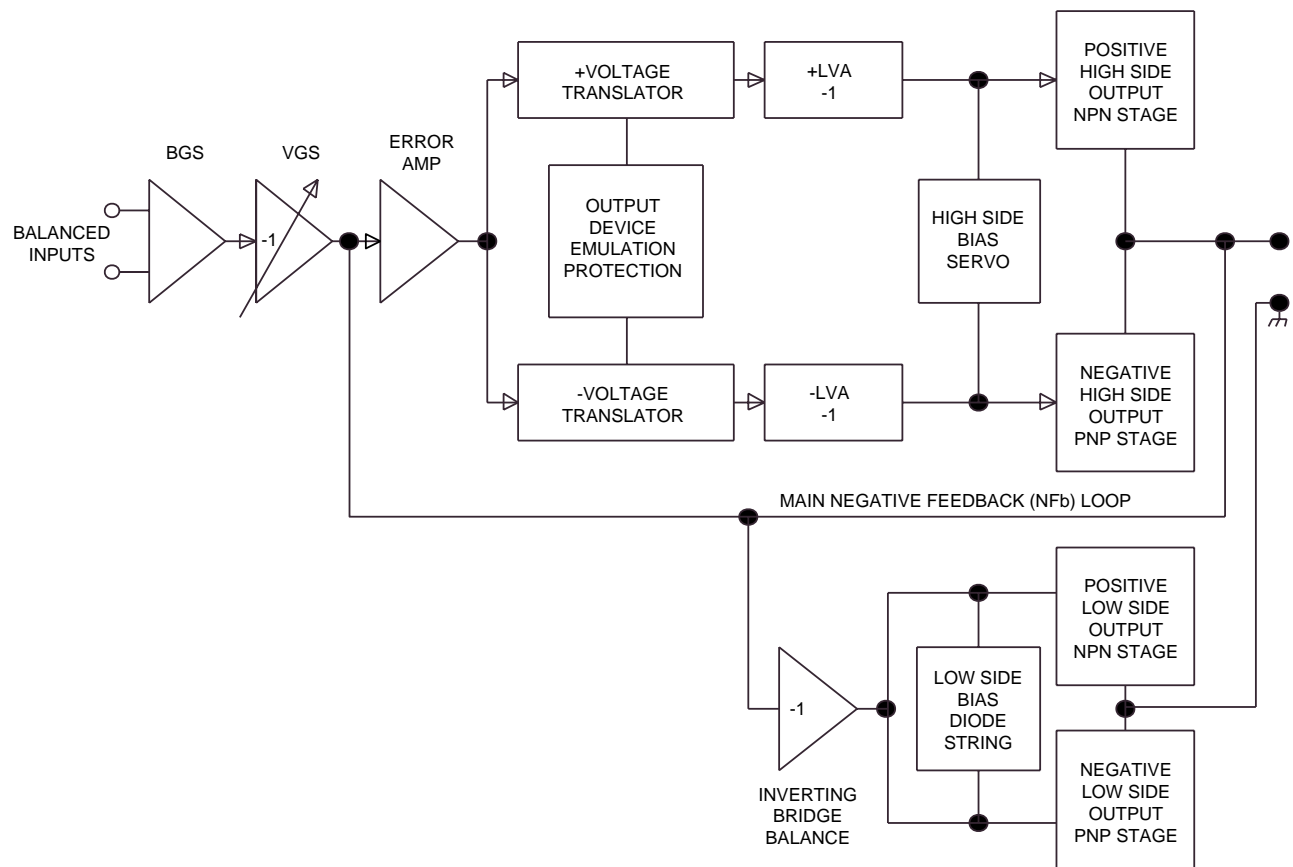


Figure 3. Typical Crown Amplifier Basic Block Diagram (One Channel Shown)

Electrical Checkout Procedures

General Information

The following test procedures are to be used to verify operation of this amplifier. DO NOT connect a load or inject a signal unless directed to do so by the procedure. These tests, though meant for verification and alignment of the amplifier, may also be very helpful in troubleshooting. For best results, tests should be performed in order.

All tests assume that AC power is from a regulated 120 VAC source. Test equipment includes an oscilloscope, a DMM, a signal generator, loads, and I.M.D. and T.H.D. noise test equipment.

Standard Initial Conditions

Level controls fully clockwise.
Stereo/Mono switch in Stereo.
Sensitivity switch in 26 dB fixed gain position.
70-V mode switches in the 8/4 ohm position.
It is assumed, in each step, that conditions of the amplifier are per these initial conditions unless otherwise specified.

Test 1: DC Offset

Spec: 0 VDC, ± 10 mV.
Initial Conditions: Controls per standard, inputs shorted.
Procedure: Measure DC voltage at the output connectors (rear panel). There is no adjustment for output offset. If spec is not met, there is an electrical malfunction. Slightly out of spec measurement is usually due to U104/U204 out of tolerance.

Test 2: Output Bias Adjustment

Spec: 300 to 320 mVDC.
Initial Conditions: Controls per standard, heatsink temperature less than 40°C.
Procedure: Measure DC voltages on the output module across R31 (15 ohm), adjust R26 if necessary. Measure DC voltages on the output module across R32 (15 ohm), adjust R23 if necessary. Repeat for second channel.

Test 3: ODEP Voltage Adjustment

Spec: Bias Per Chart, ± 0.1 V DC.
Initial Conditions: Controls per standard, heatsink at room temperature 20 to 30°C (68 to 86°F). Note: This adjustment should normally be performed within 2 minutes of turn on from ambient (cold) conditions. If possible measure heatsink temperature, if not measure ambient room temperature. Use this information when referencing the following chart.

The following list of ODEP bias voltages VS. temperature is based on the use of Main Modules built on any circuit board up to and including the D 7911-7 board.

| °F | °C | V _{-ODEP} | V _{+ODEP} |
|----|------|--------------------|--------------------|
| 66 | 18.9 | -10.31 | 11.41 |
| 68 | 20.0 | -10.26 | 11.36 |
| 70 | 21.1 | -10.20 | 11.30 |
| 72 | 22.2 | -10.14 | 11.24 |
| 74 | 23.3 | -10.09 | 11.19 |
| 76 | 24.4 | -10.03 | 11.13 |
| 77 | 25.0 | -10.00 | 11.10 |
| 78 | 25.6 | -9.97 | 11.07 |
| 80 | 26.7 | -9.91 | 11.01 |
| 82 | 27.8 | -9.86 | 10.96 |
| 84 | 28.9 | -9.80 | 10.90 |
| 86 | 30.0 | -9.74 | 10.84 |
| 88 | 31.1 | -9.69 | 10.79 |
| 90 | 32.2 | -9.63 | 10.73 |
| 92 | 33.3 | -9.57 | 10.67 |
| 94 | 34.4 | -9.51 | 10.61 |

The following list of ODEP bias voltages VS. temperature is based on the use of Main Modules built on the D 7993-5 board.

| °F | °C | V _{-ODEP} | V _{+ODEP} |
|----|------|--------------------|--------------------|
| 66 | 18.9 | -9.31 | 10.31 |
| 68 | 20.0 | -9.26 | 10.26 |
| 70 | 21.1 | -9.20 | 10.20 |
| 72 | 22.2 | -9.14 | 10.14 |
| 74 | 23.3 | -9.09 | 10.09 |
| 76 | 24.4 | -9.03 | 10.03 |
| 77 | 25.0 | -9.00 | 10.00 |
| 78 | 25.6 | -8.97 | 9.97 |
| 80 | 26.7 | -8.91 | 9.91 |
| 82 | 27.8 | -8.86 | 9.86 |
| 84 | 28.9 | -8.80 | 9.80 |
| 86 | 30.0 | -8.74 | 9.74 |
| 88 | 31.1 | -8.69 | 9.69 |
| 90 | 32.2 | -8.63 | 9.63 |
| 92 | 33.3 | -8.57 | 9.57 |
| 94 | 34.4 | -8.51 | 9.51 |

The following list of ODEP bias voltages VS. temperature is based on the use of Main Modules built on any circuit board after the D 7993-5 board.

| °F | °C | V _{-ODEP} | V _{+ODEP} |
|----|------|--------------------|--------------------|
| 66 | 18.9 | -10.31 | 10.31 |
| 68 | 20.0 | -10.26 | 10.26 |
| 70 | 21.1 | -10.20 | 10.20 |
| 72 | 22.2 | -10.14 | 10.14 |
| 74 | 23.3 | -10.09 | 10.09 |
| 76 | 24.4 | -10.03 | 10.03 |

Electrical Checkout Procedures

| | | | |
|----|------|--------|-------|
| 77 | 25.0 | -10.00 | 10.00 |
| 78 | 25.6 | -9.97 | 9.97 |
| 80 | 26.7 | -9.91 | 9.91 |
| 82 | 27.8 | -9.86 | 9.86 |
| 84 | 28.9 | -9.80 | 9.80 |
| 86 | 30.0 | -9.74 | 9.74 |
| 88 | 31.1 | -9.69 | 9.69 |
| 90 | 32.2 | -9.63 | 9.63 |
| 92 | 33.3 | -9.57 | 9.57 |
| 94 | 34.4 | -9.51 | 9.51 |

-ODEP Procedure: Measure pin 3 of J500 and, if necessary, adjust R121 to obtain V_{-ODEP} as specified above. Measure pin 3 of J500 and, if necessary, adjust R221 to obtain V_{-ODEP} as specified above.

+ODEP Procedure: Measure pin 4 of J500 and, if necessary, adjust R132 to obtain V_{+ODEP} as specified above. Measure pin 4 of J500 and, if necessary, adjust R232 to obtain V_{+ODEP} as specified above.

Test 4: AC Power Draw

Spec: 60 Watts maximum quiescent.

Initial Conditions: Controls per standard.

Procedure: With no input signal and no load, measure AC line wattage draw. If current draw is excessive, check for high AC line voltage or high bias voltage.

Test 5: Common Mode Rejection

Spec at 100 Hz: -70 dB.

Spec at 20 kHz: -50 dB.

Initial Conditions: Controls per standard.

Procedure: No load. Inject a 0 dBu (.775VRMS) 100 Hz sine wave into each channel, one channel at a time, with inverting and non-inverting inputs shorted together. At the output measure less than -44 dBu (4.9mVRMS). Inject a 0 dBu 20 kHz sine wave into each channel, one channel at a time, with inverting and non-inverting inputs shorted together. At the output measure less than -24 dBu (49mVRMS). For Main Modules with board numbers lower than D 7993-5 adjust N100 and N200 to calibrate CMR. For Main Modules with board number D 7993-5 or greater adjust R921 and R1021.

Test 6: Voltage Gain

Spec 26dB Gain: Gain of 20.0 \pm 3%.

Spec 0.775V 8/4 ohm Sensitivity: \pm 6%.

Spec 0.775V 70-V Sensitivity: \pm 6%.

Initial Conditions: Controls per standard.

Procedure: No load connected. Inject a 0.775 VAC 1 kHz sine wave with the Sensitivity Switch in the 26 dB position. Measure 15.5 VAC \pm 0.5 VAC at the amplifier

output. Inject a 0.775 VAC 1 kHz sine wave with the Sensitivity Switch in the 0.775V 8/4 ohm position. Measure 28.9 VAC \pm 1.7 VAC at the amplifier output. Inject a 0.775 VAC 1 kHz sine wave with the Sensitivity Switch in the 0.775 VAC 70-V position and the Output Mode Switch in the 70-V position. Measure 70.7 VAC \pm 4.2 VAC at the amplifier output. Return the Sensitivity Switch to the 26 dB position. Return the Output Mode Switches to the 8/4 ohm position.

Test 7: Phase Response

Spec: \pm 10° from 10 Hz to 20 kHz at 1 Watt.

Initial Conditions: Controls per standard, 8 ohm load on each channel.

Procedure: Inject a 1 kHz sine wave and adjust for 1 watt output (2.8 VAC). Check input and output signals against each other, input and output signals must be within 10° of each other.

Test 8: Level Controls

Spec: Level controlled by level controls.

Initial Conditions: Controls per standard.

Procedure: No load. Inject a 1 kHz sine wave. With level controls fully clockwise you should see full gain. As controls are rotated counterclockwise, observe similar gain reduction in each channel. When complete, return level controls to fully clockwise position.

Test 9: Current Limit

Spec: Current Limit at 13 Amps, \pm 2 Amps.

Initial Conditions: Controls per standard.

Procedure: Load each channel to 1 ohm. Inject a 1 kHz differentiated (or 10% duty cycle) square wave. See figure 4. Increase output level until current limit occurs. Current limit should occur at 13 \pm 2 Amps (13 Vpk). Observe clean (no oscillations) current clipping.

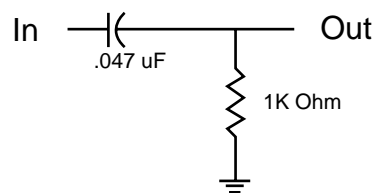


Figure 4. Differentiator Circuit

Electrical Checkout Procedures

Test 10: Slew Rate & 10 KHz Square Wave

Spec: 17 - 25 V/ μ S, 8 ohm load.

Initial Conditions: Controls per standard.

Procedure: Load each channel to 8 ohms. Inject a 10 kHz square wave to obtain 35 Volts zero-to-peak at each output. Observe the slope of the square wave. It should typically measure 17-25 V/ μ S. Also, the square wave must not include overshoot, ringing, or any type of oscillation.

Test 11: Crosstalk

Spec: -60 dB at 20 kHz.

Initial Conditions: Controls per standard. Terminate input of channel not driven with 600 ohms.

Procedure: 8 ohm load on each channel. Inject a 20 kHz sine wave into the channel 1 input and increase output level to 29 VAC. Measure less than 29 mVAC at the output of channel 2. Inject a 20 kHz sine wave into the channel 2 input and increase output level to 29 VAC. Measure less than 29 mVAC at the output of Ch 1.

Test 12: Output Power

Spec at 8 Ohm Stereo: \geq 105 Watts/Ch at 0.1% THD

Spec at 4 Ohm Stereo: \geq 140 Watts/Ch at 0.1% THD

Spec at 70-V Mode, Stereo: \geq 100 Watts/Ch at 0.1% THD, 50 Ohm load.

Initial Conditions: Controls per standard

Procedure: Load each channel to 8 ohms. Inject a 1 kHz sine wave and measure at least 28.98 VAC at the output of each channel. Load each channel to 4 ohms. Inject a 1 kHz sine wave and measure at least 23.66 VAC at the output of each channel. Switch each channel to the 70-V mode. Load each channel to 50 ohms. Inject a 1 kHz sine wave and measure at least 70.7 VAC at the output of each channel. All power measurements must be at less than 0.1% THD.

Test 13: Reactive Loads

Spec: No oscillations. Safe with all types of loads.

Initial Conditions: Controls per standard.

Procedure Capacitive: Load each channel to 8 ohms in parallel with 2 μ F. Inject a 20 kHz sine wave with 22 VAC output for 10 seconds.

Procedure Inductive: Load each channel to 8 ohms in parallel with 159 μ H. Inject a 1 kHz sine wave with 15 VAC output for 10 seconds.

Procedure Torture: Load each channel with the primary (red and black leads) of a PS-U transformer (CPN D 7040-5). Each channel in the 70-V mode. Inject a 10 Hz sine wave with an output level sufficient enough to cause 3 to 5 flyback pulses for 10 seconds.

Procedure Short: Inject a 60 Hz sine wave into the input and adjust for 5 VAC at the output. Short each channel, one at a time, for 10 seconds.

Test 14: ODEP Limiting

Spec: No oscillation on ODEP limiting wave form; either channel controls limiting in Parallel Mono mode.

Initial Conditions: Controls per standard; rag or other obstruction blocking fan blade so it does not turn (if FAN is installed).

Procedure: Load the amplifier to 2 ohms per channel. Inject a 60 Hz sine wave into each channel and adjust the output to 10 VAC. Allow the amplifier to heat up until you observe a wave form similar to figure 5. Allow the amplifier to cool for a few minutes. Switch the amplifier to Parallel Mono mode and remove the load from channel 2. Inject a 60 Hz sine wave into each channel and adjust the output to 10 VAC. Allow the amplifier to heat up and observe limiting on both channels.

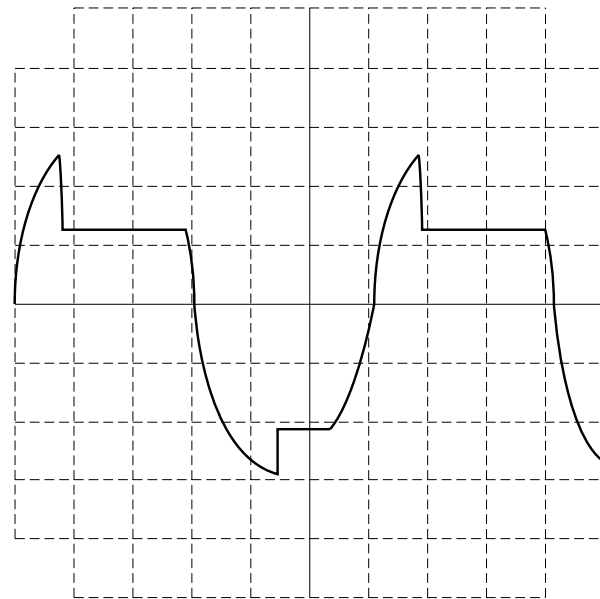


Figure 5. ODEP Limiting Wave Form

Test 15: LF Protection

Spec: Amplifier mutes for dangerous subsonic frequencies.

Initial Conditions: Controls per standard.

Procedure: No load. Inject a .5 Hz 6 Vp-p, or a 2 Hz 6 VAC sine wave into each channel and verify that each channel cycles into mute.

Electrical Checkout Procedures

Test 16: Signal to Noise Ratio

Spec: ≥ 100 dB below 8 ohm rated continuous average 20-20kHz power.

Initial Conditions: Controls per standard. Short inputs.

Procedure: Load each channel to 8 ohms. Measure less than $290\mu\text{V}$ at the output of each channel (20 Hz-20 kHz bandpass filter).

Test 17: Turn off Transients

Spec: $< 80\text{mV}$ across an 8 ohm speaker load

Initial Conditions: Controls per standard.

Procedure: Load the output with an 8 ohm speaker. From an on condition, turn off the amplifier and monitor the output noise at the time of turn off.

Note: Turn off noise may increase significantly if the amplifier is cycled off and on.

Test 18: Intermodulation Distortion

Spec at 0 dB output: $\leq 0.01\%$.

Spec at -35 dB output: $\leq 0.05\%$.

Initial Conditions: Controls per standard.

Procedure: Load each channel to 8 ohms. Inject a SMPTE standard IM signal (60 Hz and 7 kHz sine wave mixed at 4:1 ratio). Set the 60 Hz portion of the sine wave to 23 volts RMS. Set the 7 kHz portion to 25%. With an IM analyzer measure less than 0.01% IMD. Repeat test at -35 dB (reference 23 volts RMS, 60 Hz portion) and measure less than 0.05% IMD.

Test 19: Clipping

Spec: No protective action during test.

Initial Conditions: Controls per standard.

Procedure: Load each channel to 8 ohms. Inject a 1 kHz sine wave into each input and drive the output 6 dB into clip for 10 seconds. The amplifier should not activate any protective circuits (ODEP, Fault, or LF Protection).

Post Testing

After completion of testing, if all tests are satisfactory, the amplifier controls should be returned to the positions required by customer. If conditions are unknown or unspecified, factory settings are as follows:

Level Controls: 9 to 11 O'Clock.

Sensitivity Switch: 0.775V 8/4 Ohm.

Stereo/Mono Switch: Stereo.

70-V Mode Switches: 8/4 Ohm position.

Power: Off

Parts List (Non-Module)

Supplimental Items

| <i>CPN</i> | <i>Item</i> | <i>Quantity</i> |
|--------------|---|-----------------|
| A10087-71012 | Rack Screw, 10-32 x .75 | 8 |
| C 3342-0 | Feet, Selfstick Black | 4 |
| D 4137-2 | Nylon Washer | 4 |
| A10086-70808 | Screw, 8-32 x .5 (For volume cover) | 2 |
| A10101-12 | Spacer, #8 x 5/16OD x 1/4L (For volume cover) | 2 |
| F11489-6 | Plexiglass Plate (Volume cover) | 1 |
| K80636-2 | CT Series Reference Manual | 1 |

Power Supply

| <i>CPN</i> | <i>Item</i> | <i>Quantity</i> |
|--------------|---------------------------------------|-----------------|
| A10087-11028 | Screw, 10-32 x 1.75 (For transformer) | 4 |
| C 10171-4 | Breaker, 8 Amp VDE | 1 |
| C10168-0 | Breaker, 4 Amp VDE (200V-240V Models) | 1 |
| D 7212-0 | Power Transformer (120V 60 Hz) | 1 |
| D 7224-5 | Power Transformer (220V/240V) | 1 |
| D 8022-2 | Power Transformer (100V/120V) | 1 |
| A10099-7 | Nylon Shoulder Washer, #10 | 4 |
| A10095-4 | Lockwasher, #10 External Star | 4 |
| A10098-5 | Washer, 1/4" Belleville Spring | 4 |
| C 8752-5 | Bridge Rectifier, 35A 400V | 2 |
| C 9852-2 | Capacitor, 6300µF 200V Electrolytic | 2 |
| C 9870-4 | Screw, 10-32 x .38 | 4 |
| D 2934-4 | Solder Lug, .218 Hole | 4 |
| D 6764-1 | Washer, Shoulder | 4 |
| D 8438-0 | Bracket, Capacitor | 2 |

Output Assembly (One Per Channel)

| <i>CPN</i> | <i>Item</i> | <i>Quantity (Per Channel)</i> |
|------------|--|-------------------------------|
| A10315-1 | Screw, 6-32 x .56 Hex Washer Head | 12 |
| C 8188-2 | Output Power Transistor, PNP | 2 |
| D 6729-4 | Output Power Transistor, NPN | 2 |
| C 7065-3 | Output Power Transistor, PNP (early units) | 2 |
| C 8573-5 | Driver Transistor, 2SA1186 PNP | 2 |
| C 8574-3 | Driver Transistor, 2SC2837 NPN | 2 |
| M20591-0 | Old Style Driver Transistor Assm. NPN, 2SC2527 | 2 |
| M20590-2 | Old Style Driver Transistor Assm. PNP, 2SA1077 | 2 |
| D 7665-9 | Mounting Clip, TO3P (For Drivers) | 2 |
| D 7666-7 | Mounting Bracket, TO3P (For Drivers) | 2 |
| D 7796-2 | Sil Pad, 2.87 x 14.57 (Between Heatsink & Chassis) | 1 |
| D 6280-8 | Sil Pad for use with Output Board P10315-3 | 1 |
| D 6104-0 | Sil Pad for use with Output Board P10233-8 | 1 |
| D 7797-0 | Output Pad (Between Module and Chassis) | 1 |
| C 7597-4 | Output Pad for use with Output Board P10315-3 | 1 |
| D 7026-4 | Output Pad for use with Output Board P10233-8 | 1 |
| D 8774-8 | PTC, 95DegC Cast Alum. | 1 |
| F12019-0 | Heatsink (Under Diode String) | 1 |
| C 8813-5 | Bias Transistor MPS8097/MPSA18 NPN (Q18) | 1 |
| B 5842-8 | Tubing, #24 Thin Wall Red (For Q18) | Order in Inches |
| C 5826-0 | LM234Z-6 Thermal Sense (S100/200) | 1 |
| B 5464-1 | Tubing, #24 Teflon Thin Wall | Order in Inches |
| M21324-5 | Aluminum Heat Sink, 3/4" With Fins | 2 |

Parts List (Non-Module)

Back Panel Assembly

| <i>CPN</i> | <i>Item</i> | <i>Quantity</i> |
|--------------|---|-----------------|
| D 8367-1 | Knob, .5 Dia. Level Control | 2 |
| A10086-10410 | Screw, 4-40 x .62 | 2 |
| A10086-70808 | Screw, 8-32 x .5 | 4 |
| A10094-2 | Lockwasher, #4 Internal Star | 2 |
| A10100-7 | Aluminum Spacer, .250OD x .140ID x .312L | 2 |
| A10109-70808 | Screw, 8-18 x .5 | 4 |
| A10214-4 | Strain Relief | 1 |
| C10187-0 | Strain Relief (For European Power Cord) | 1 |
| A11793-0105D | Power Cord, 16-3 SJT Neon UL/CSA | 1 |
| A10793-0503D | Power Cord, European Plug (E-13 Amplifiers) | 1 |
| C 4508-5 | IC Socket, 16 Pin | 1 |
| C 5990-4 | Barrier Block, 4 Term. | 1 |
| C 6821-0 | Edge Card Connector, 22 Contact | 1 |
| C 7957-1 | Slide Switch, DPDT 15A (70-V Mode) | 2 |
| C 8812-7 | Cable Tie, 5.5" | 2 |
| C10060-9 | Header, 5 Pin R Angle Locking | 1 |
| D 6899-5 | Ribbon Connector, PIP Daisy | 1 |
| D 7623-8 | Cable, 10" 22AWG With Terminals | 1 |
| F12690-8 | Back Panel | 1 |
| P10286-6 | PIP Interconnect Board | 1 |

Chassis Front Assembly

| <i>CPN</i> | <i>Item</i> | <i>Quantity</i> |
|--------------|--|-----------------|
| A10031-1 | Captive Nut, 8-32 x .060 Flush (For rack ears) | 4 |
| A10090-70808 | Screw, 8-32 x .5 Oval Head (For Grille) | 3 |
| A10101-5 | Nylon Washer, .5 x .136 x .02 (For Grille) | 3 |
| A10173-1 | Clip, Filter Grille | 3 |
| C 5297-4 | Screw, 8-32 x .37 (For rack ears) | 4 |
| C 6487-0 | Power Switch, 2 Pole 22 Amp Rocker | 1 |
| D 6944-9 | Air Filter, 1.45 x 16.23 | 1 |
| F11439J0 | Front Panel Overlay | 1 |
| F12706-2 | End Cap (For Rack ears) | 2 |
| F12710-4 | Grille, Filter | 1 |

Main Chassis Assembly

| <i>CPN</i> | <i>Item</i> | <i>Quantity</i> |
|--------------|---|-----------------|
| A10094-3 | Washer, #6 Internal Star, Black | 8 |
| A10110-70605 | Screw, 6-32 x .312 Taptite (For covers) | 7 |
| D 7249-2 | Label, 3 Position Voltage Gain | 1 |
| D 8501-5 | Top Cover | 1 |
| D 8548-6 | Bottom Cover | 1 |
| A10086-10606 | Screw, 6-32 x .375 | 4 |
| A10086-70806 | Screw, 8-32 x .37 | 1 |
| A10094-3 | Washer, #6 Internal Star, Black | 3 |
| A10094-6 | Washer, #8 Internal Star | 2 |
| A10109-10822 | Screw, 8-18 x 1.375 | 2 |
| A10110-70812 | 8-32 x .750 Taptite | 2 |
| A10192-1 | Snap Bushing, OCB .500 | 3 |
| C 1811-6 | 4" Cable Tie | 8 |
| C 3163-0 | Solder Lug, #6 | 2 |

Parts List (Non-Module)

Main Chassis Assembly Cont.

| <i>CPN</i> | <i>Item</i> | <i>Quantity</i> |
|------------|----------------------------------|-----------------|
| C 6457-3 | Screw, #8 x 3/8 | 2 |
| C 6912-7 | Tension Retaining Board Supports | 2 |
| C 6913-5 | 1" Spacer Toggle Nut, Plastic | 2 |
| C 6914-3 | .75" Spacer Toggle Nut, Plastic | 2 |
| C 7705-4 | Flat Cable Clamp | 2 |
| C 9491-9 | Screw, 6-32 x .312 | 3 |
| C 9953-8 | Screw, 6-20 x .312 | 6 |
| C10111-0 | Button, Mtg. | 2 |
| D 7060-3 | Sil Pad, 7 Mil 2.05 x .775 | 1 |
| F11632-1 | Bracket, Transformer Mtg. | 1 |
| F12642-9 | Chassis, 3.5" | 1 |

PIP-BB

| <i>CPN</i> | <i>Item</i> | <i>Quantity</i> |
|--------------|------------------------------------|-----------------|
| M46011-9 | PIP-BB Assembly | 1 |
| A10086-70806 | Screw, 8-32 x .37 | 2 |
| A10094-5 | Lockwasher, #8 Internal Star Black | 2 |
| A10110-10608 | Screw, 6-32 x .5 | 4 |
| A10266-2202 | Resistor, 22 Ohm .5W | 2 |
| C 3842-9 | Barrier Block, 3 Position | 2 |
| C 6806-1 | Capacitor, .01μF 100V | 2 |
| C 7161-0 | Screw, #8 x 1/4 #6 PNHD | 2 |
| F12553J7 | Panel | 1 |
| P10343-5 | PC Board | 1 |

CT-200 Fan Assembly (Optional on Domestic Units)

| <i>CPN</i> | <i>Item</i> | <i>Quantity</i> |
|--------------|----------------------------------|-----------------|
| M44084-8 | CT Fan Assembly | 1 |
| A10110-70605 | Screw, 6-32 x .312 Taptite | 2 |
| C 7062-0 | Screw, 6-32 x 5/16 | 2 |
| C 9939-7 | Fan Blade | 1 |
| D 8439-8 | Fan Bracket | 1 |
| H43495-3 | Fan Motor with Faston Connectors | 1 |

Module and Schematic Information

Module History

The Com Tech 200B amplifier was introduced in 1990. Since then there have been several updates and revisions, some of which called for new modules. The following is a list of all modules used up to this date, December 1995.

Output Modules: (left and right are identical)

Q42716-3

Original Output Module on P10233-8 or P10263-5 board.

Q42888-0

Output Module on P10315-3 board.

Q42969-8

Output Module on P10337-7 board. No longer available. Use Q43188-4 as service replacement.

Q43188-4

Output Module on P10396-3 board.

Main Modules:

Q42774-2

Original B Version Main Module. This Module's parts list is not documented. No longer available. Use Q43128-0 as a service replacement.

Q42922-7

Main Module on D 7605-5 board. This Module's parts list is not documented. No longer available. Use Q23128-0 as a service replacement.

Q43013-4

Main Module on D 7911-7 board. This module is still available at this time. If not, then use Q43128-0 as a service replacement.

Q43044-9

Main Module on D 7993-5 board. No longer available. Use Q43128-0 as service replacement.

Q43128-0

Main Module on D 8283-0 board.

Q43237-9

Main Module on D 8369-7 board. Detent Pots. Not reverse compatible.

Control Module:

Q42762-7

CT-200/400 fan control on P10317-9 board.

Q43215-5

CT-200 fan control on P10404-5 board.

Q43244-5

CT control module for 120V, 60 Hz only. On P10405-2 board.

Q43242-9

CT control module for Export models. On P10405-2 board.

Display Module:

Q42706-4

CT display on D 7083-5 board.

Schematic Information:

The schematics provided are representative only. There may be slight variations between amplifier to amplifier. These schematics are intended to be used for troubleshooting purposes only.

For amplifiers with main boards D 7605-5, D 7911-7, D 7993-5, and D 8283-0 or earlier, refer to schematic number J0552-3.

For amplifiers with main board D 8369-7 refer to schematic number J0630-4.

Q42762-7 Control Module (P10317-9 board) Parts Lists

Capacitors

| | | | |
|------|------|----------|------------|
| C700 | C800 | C 8426-6 | .1μF 250V |
| C701 | C801 | C 8426-6 | .1μF 250V |
| C900 | | C 8963-8 | .47μF 250V |
| C901 | | C 8963-8 | .47μF 250V |

Diodes

| | | | |
|------|------|----------|--------|
| D700 | D800 | C 3181-2 | 1N4148 |
| D900 | | C 2851-1 | 1N4004 |

Relays

| | | | |
|----|--|----------|------|
| K1 | | C 7860-7 | SPST |
|----|--|----------|------|

Transistors

| | | | |
|------|------|----------|----------------|
| Q700 | Q800 | C 3625-8 | PNP 2N4125 |
| Q701 | Q801 | C 7663-5 | Triac MAC224A4 |
| Q900 | | C 3625-8 | PNP 2N4125 |
| Q901 | | C 3625-8 | PNP 2N4125 |
| Q902 | | C 3625-8 | PNP 2N4125 |

Resistors

| | | | |
|------|------|-------------|----------|
| R700 | R800 | A10266-1222 | 1.2K .5W |
| R701 | R801 | A10266-1812 | 180 .5W |
| R900 | | A10266-2722 | 2.7K .5W |
| R901 | | A10266-1021 | 1.5K .5W |
| R902 | | C 7669-2 | 300 10W |
| R903 | | C 7669-2 | 300 10W |
| R904 | | A10266-3902 | 39 .5W |
| R905 | | A10266-3602 | 36 .5W |

ICs

| | | | |
|------|------|----------|-------------------|
| U700 | U800 | C 7664-3 | MOC3031 Optotriac |
| U901 | | C 7665-0 | MOC3011 Optotriac |
| U902 | | C 7665-0 | MOC3011 Optotriac |

Misc.

| | | | |
|--------------|--|----------|-------------------------------|
| Board | | P10317-9 | |
| J900 | | C 7672-6 | 8 Pin MTA Header |
| Tab Terminal | | C 7817-7 | W1-W3, W100-W102 W200-W202 |
| 0 Ohm Jmp | | C 5868-2 | |

Q43215-5 Control Module (P10404-5 board) Parts List

Capacitors

| | | | |
|------|------|----------|------------------|
| C700 | C800 | C 8426-6 | .1 μ F 250V |
| C701 | C801 | C 8426-6 | .1 μ F 250V |
| C900 | | C 8963-8 | .47 μ F 250V |
| C901 | | C 8963-8 | .47 μ F 250V |

Diodes

| | | | |
|------|------|----------|--------|
| D700 | D800 | C 3181-2 | 1N4148 |
| D900 | | C 2851-1 | 1N4004 |

Relays

| | | | |
|----|--|----------|------|
| K1 | | C 7860-7 | SPST |
|----|--|----------|------|

Transistors

| | | | |
|------|------|----------|----------------|
| Q700 | Q800 | C 3625-8 | PNP 2N4125 |
| Q701 | Q801 | C 7663-5 | Triac MAC224A4 |
| Q900 | | C 3625-8 | PNP 2N4125 |
| Q901 | | C 3625-8 | PNP 2N4125 |
| Q902 | | C 3625-8 | PNP 2N4125 |

Resistors

| | | | |
|------|------|-------------|----------|
| R700 | R800 | A10266-1222 | 1.2K .5W |
| R701 | R801 | A10266-1812 | 180 .5W |
| R900 | | A10266-2722 | 2.7K .5W |
| R901 | | A10266-1021 | 1.5K .5W |
| R902 | | C 7669-2 | 300 10W |
| R903 | | C 7669-2 | 300 10W |
| R904 | | A10266-3902 | 39 .5W |
| R905 | | A10266-3602 | 36 .5W |

ICs

| | | | |
|------|------|----------|-------------------|
| U700 | U800 | C 7664-3 | MOC3031 Optotriac |
| U901 | | C 7665-0 | MOC3011 Optotriac |
| U902 | | C 7665-0 | MOC3111 Optotriac |

Misc.

| | | | |
|--------------|--|----------|-------------------------------|
| Board | | P10404-5 | |
| J900 | | C 7672-6 | 8 Pin MTA Header |
| Tab Terminal | | C 7817-7 | W1-W3, W100-W102 W200-W202 |

Q43244-5 Control Module (P10405-2 board) Parts List

Capacitors

| | | | |
|------|------|----------|------------|
| C700 | C800 | C 8426-6 | .1μF 250V |
| C701 | C801 | C 8426-6 | .1μF 250V |
| C900 | | C 8963-8 | .47μF 250V |
| C901 | | C 8963-8 | .47μF 250V |

Diodes

| | | | |
|------|------|----------|--------|
| D700 | D800 | C 3181-2 | 1N4148 |
| D900 | | C 2851-1 | 1N4004 |

Relays

| | | | |
|----|--|----------|------|
| K1 | | C 7860-7 | SPST |
|----|--|----------|------|

Transistors

| | | | |
|------|------|----------|----------------|
| Q700 | Q800 | C 3625-8 | PNP 2N4125 |
| Q701 | Q801 | C 7663-5 | Triac MAC224A4 |
| Q900 | | C 3625-8 | PNP 2N4125 |
| Q901 | | C 3625-8 | PNP 2N4125 |
| Q902 | | C 3625-8 | PNP 2N4125 |

Resistors

| | | | |
|------|------|-------------|----------|
| R700 | R800 | A10266-3622 | 3.6K .5W |
| R701 | R801 | A10266-1812 | 180 .5W |
| R702 | R802 | A10266-3622 | 3.6K .5W |
| R703 | R803 | A10266-3622 | 3.6K .5W |
| R900 | | A10266-2722 | 2.7K .5W |
| R901 | | A10266-1021 | 1.5K .5W |
| R902 | | C 7669-2 | 300 10W |
| R903 | | C 7669-2 | 300 10W |
| R904 | | A10266-3902 | 39 .5W |
| R905 | | A10266-3602 | 36 .5W |

ICs

| | | | |
|------|------|----------|-------------------|
| U700 | U800 | C 7664-3 | MOC3031 Optotriac |
| U901 | | C 7665-0 | MOC3011 Optotriac |
| U902 | | C 7665-0 | MOC3011 Optotriac |

Misc.

| | | | |
|--------------|--|----------|-------------------------------|
| Board | | P10405-2 | |
| J900 | | C 7672-6 | 8 Pin MTA Header |
| Tab Terminal | | C 7817-7 | W1-W3, W100-W102 W200-W202 |
| 0 Ohm Jmp | | C 5868-2 | |

Q43242-9 Control Module (P10405-2 board) Parts List

Capacitors

| | | | |
|------|------|----------|------------------|
| C700 | C800 | C 8426-6 | .1 μ F 250V |
| C701 | C801 | C 8426-6 | .1 μ F 250V |
| C900 | | C 8963-8 | .47 μ F 250V |
| C901 | | C 8963-8 | .47 μ F 250V |

Diodes

| | | | |
|------|------|----------|--------|
| D700 | D800 | C 3181-2 | 1N4148 |
| D900 | | C 2851-1 | 1N4004 |

Relays

| | | | |
|----|--|----------|------|
| K1 | | C 7860-7 | SPST |
|----|--|----------|------|

Transistors

| | | | |
|------|------|----------|----------------|
| Q700 | Q800 | C 3625-8 | PNP 2N4125 |
| Q701 | Q801 | C 7663-5 | Triac MAC224A4 |
| Q900 | | C 3625-8 | PNP 2N4125 |
| Q901 | | C 3625-8 | PNP 2N4125 |
| Q902 | | C 3625-8 | PNP 2N4125 |

Resistors

| | | | |
|------|------|-------------|----------|
| R700 | R800 | A10266-3622 | 3.6K .5W |
| R701 | R801 | A10266-1812 | 180 .5W |
| R702 | R802 | A10266-3622 | 3.6K .5W |
| R703 | R803 | A10266-3622 | 3.6K .5W |
| R900 | | A10266-2722 | 2.7K .5W |
| R901 | | A10266-1021 | 1.5K .5W |
| R902 | | C 7669-2 | 300 10W |
| R903 | | C 7669-2 | 300 10W |
| R904 | | A10266-3902 | 39 .5W |
| R905 | | A10266-3602 | 36 .5W |

ICs

| | | | |
|------|------|----------|-------------------|
| U700 | U800 | C 7664-3 | MOC3031 Optotriac |
| U901 | | C 7665-0 | MOC3011 Optotriac |
| U902 | | C 7665-0 | MOC3011 Optotriac |

Misc.

| | | | |
|--------------|--|----------|-------------------------------|
| Board | | P10405-2 | |
| J900 | | C 7672-6 | 8 Pin MTA Header |
| J901 | | C 7873-0 | 2 Pin MTA Header |
| Tab Terminal | | C 7817-7 | W1-W3, W100-W102 W200-W202 |
| 0 Ohm Jmp | | C 5868-2 | |

Q42706-4 Display Module (D 7083-5 board) Parts List

Capacitors

| | | | |
|------|------|----------|-----------|
| C500 | C600 | C 6802-0 | .47µF 50V |
| C901 | | C 6804-6 | .1µF 50V |

Diodes

| | | | |
|------|------|----------|------------------|
| D500 | D600 | C 3181-2 | 1N4148 |
| D501 | D601 | C 3181-2 | 1N4148 |
| D900 | | C 3533-4 | 1N966B 16V Zener |
| D901 | | C 3533-4 | 1N966B 16V Zener |

LED's

| | | | |
|------|------|----------|--------|
| E500 | E600 | C 7863-1 | Green |
| E501 | E601 | C 4431-0 | Yellow |
| E502 | E602 | C 7863-1 | Green |
| E900 | | C 4342-9 | Amber |

Transistors

| | | | |
|------|------|----------|--------|
| Q500 | Q600 | C 3625-8 | 2N4125 |
| Q501 | Q601 | C 3625-8 | 2N4125 |
| Q502 | Q602 | C 7458-0 | 2N4123 |
| Q503 | Q603 | C 3625-8 | 2N4125 |

Resistors

| | | | |
|------|------|-------------|---------|
| R500 | R600 | A10266-1031 | 10K |
| R501 | R601 | A10266-2221 | 2.2K |
| R502 | R602 | A10266-1051 | 1M |
| R503 | R603 | A102662751 | 2.7M |
| R504 | R604 | A10266-2032 | 20K .5W |
| R505 | R605 | A10266-2221 | 2.2K |
| R506 | R606 | A10266-4751 | 4.7M |
| R507 | R607 | A10266-2221 | 2.2K |
| R508 | R608 | A10266-1021 | 1K |
| R905 | | A10266-5141 | 510K |
| R906 | | A10266-2721 | 2.7K |
| R907 | | A10266-5141 | 510K |
| R908 | | A10266-3931 | 39K |
| R909 | | A10266-3931 | 39K |
| R910 | | A10266-4741 | 470K |
| R911 | | A10266-3931 | 39K |
| R912 | | A10266-1041 | 100K |
| R913 | | A10266-1031 | 10K |
| R914 | | A10266-8211 | 820 |
| R915 | | A10266-3931 | 39K |
| R916 | | A10266-3631 | 36K |
| R917 | | A10266-8211 | 820 |
| R918 | | A10266-3931 | 39K |

Integrated Circuits

| | | |
|------|----------|--------|
| U903 | C 4345-2 | LMT339 |
| U904 | C 7661-9 | LM358N |
| U905 | C 4345-2 | LMT339 |

Misc.

| | | |
|------------|----------|--|
| Board | D 7083-5 | |
| IC Socket | C 4508-5 | 16 Pin |
| LED Spacer | C 7712-0 | |
| Cable | H42913-6 | 8 Cond 24AWG Ribbon Cable with Connector |

Q42716-3 Output Module (P10233-8 or P10263-5 board) Parts List

Capacitors

| | | |
|-----|----------|--------------|
| C01 | C 3978-1 | .047 μ F |
| C02 | C 2938-6 | .1 μ F |
| C03 | C 2938-6 | .1 μ F |
| C04 | C 6806-1 | .01 μ F |
| C05 | C 6806-1 | .01 μ F |
| C06 | C 6806-1 | .01 μ F |
| C07 | C 6807-9 | .001 μ F |
| C08 | C 6809-5 | 220pF |
| C09 | C 6850-7 | 180pF |

Diodes

| | | |
|-----|----------|--------|
| D01 | C 2851-1 | 1N4004 |
| D02 | C 2851-1 | 1N4004 |
| D03 | C 2851-1 | 1N4004 |
| D04 | C 2851-1 | 1N4004 |
| D05 | C 2851-1 | 1N4004 |
| D06 | C 2851-1 | 1N4004 |
| D07 | C 2851-1 | 1N4004 |
| D08 | C 2851-1 | 1N4004 |
| D09 | C 2851-1 | 1N4004 |
| D10 | C 2851-1 | 1N4004 |
| D11 | C 2851-1 | 1N4004 |
| D12 | C 2851-1 | 1N4004 |

Inductors

| | | |
|-----|----------|-------------------------|
| L00 | C 6592-6 | 1.3 μ H Output Coil |
| L01 | C 3510-2 | 470 μ H |
| L02 | C 3510-2 | 470 μ H |

Transistors

| | | |
|-----|----------|------------|
| Q17 | C 7271-7 | NPN MPSU10 |
| Q19 | C 7318-6 | PNP MPSU60 |

Note: Q18, S100, Driver Transistors, and Output Transistors are not included with Output Module. See Output Assembly parts list for these part numbers.

Resistors

| | | |
|------|-----------|-----------------|
| R00 | C 2626-7 | 470 |
| R01 | C 2872-7 | 100 |
| R02 | C 3299-2 | 5.6 .5W |
| R04 | C 6486-2 | .2 5W |
| R07 | C 6486-2 | .2 5W |
| R09 | C 4479-9 | 22 |
| R10 | C 2872-7 | 100 |
| R11 | C 7317-8 | 2.7 5W |
| R12 | C 1001-4 | 2.7 1W |
| R13 | C 2626-7 | 470 |
| R16 | C 6486-2 | .2 5W |
| R19 | C 6486-2 | .2 5W |
| R21 | C 3299-2 | 5.6 .5W |
| R22 | C 4479-9 | 22 |
| R23 | C 6844-2 | 250 Pot LS Bias |
| R24 | C 4300-7 | 13K |
| R25 | C 2628-3 | 2.2K |
| R26 | C 6844-2 | 250 Pot HS Bias |
| R27 | C 6495-3 | 390 |
| R28 | C 4300-7 | 13K |
| R30* | C 6626-3* | 102* |

Misc.

| | |
|-----------|------------------------|
| Board | P10233-8 or P10263-5 |
| Jumpers | C 5868-2 0 Ohm .25W |
| J500 J600 | C 7057-0 10 Pin Header |

*Note: R30 is 102 Ohms in most units, though in some cases a different value may be used to match the installed S100/S200 LM334 (C5826-0) device grade. This is the standard value and is used with the most common LM334 grade, green. If the LM334 is marked with a blue dot, R30 should be a 107 Ohm resistor (A10265-10701); if it is marked with a yellow dot then R30 should be a 100 Ohm resistor (A10265-10001).

Q42888-0 Output Module (P10315-3 board) Parts List

Capacitors

| | | |
|-----|----------|----------------|
| C01 | C 8511-5 | .047μF 250V Ax |
| C02 | C 8426-6 | .1μF |
| C03 | C 8426-6 | .1μF |
| C04 | C 6805-3 | .022μF |
| C05 | C 6805-3 | .022μF |
| C06 | C 6806-1 | .01μF 100V Ax |
| C07 | C 6807-9 | .001μF 100V Ax |
| C08 | C 6809-5 | 220pF |
| C09 | C 6810-3 | 180pF |

Diodes

| | | |
|-----|----------|--------|
| D01 | C 2851-1 | 1N4004 |
| D02 | C 2851-1 | 1N4004 |
| D03 | C 2851-1 | 1N4004 |
| D04 | C 2851-1 | 1N4004 |
| D05 | C 2851-1 | 1N4004 |
| D06 | C 2851-1 | 1N4004 |
| D07 | C 2851-1 | 1N4004 |
| D08 | C 2851-1 | 1N4004 |
| D09 | C 2851-1 | 1N4004 |
| D10 | C 2851-1 | 1N4004 |
| D11 | C 2851-1 | 1N4004 |
| D12 | C 2851-1 | 1N4004 |

Inductors

| | | |
|-----|----------|-------------------|
| L00 | C 6592-6 | 1.3μH Output Coil |
| L01 | C 3510-2 | 470μH |
| L02 | C 3510-2 | 470μH |

Transistors

| | | |
|-----|----------|--------------|
| Q17 | C 8508-1 | NPN 2SC3298B |
| Q19 | C 8509-9 | PNP 2SA1306B |

Note: Q18, S100, Driver Transistors, and Output Transistors are not included with Output Module. See Output Assembly parts list for part numbers.

Resistors

| | | |
|------|-----------|---------------------|
| R00 | C 2626-7 | 470 |
| R01 | C 2872-7 | 100 |
| R02 | C 7778-1 | 5.6 .5W Flame Proof |
| R04 | C 6486-2 | .2 5W |
| R07 | C 6486-2 | .2 5W |
| R09 | C 7779-9 | 22 Flame Proof |
| R10 | C 2872-7 | 100 |
| R11 | C 7317-8 | 2.7 5W |
| R12 | C 1001-4 | 2.7 1W |
| R13 | C 2626-7 | 470 |
| R16 | C 6486-2 | .2 5W |
| R19 | C 6486-2 | .2 5W |
| R21 | C 7778-1 | 5.6 .5W Flame Proof |
| R22 | C 7779-9 | 22 Flame Proof |
| R23 | C 6844-2 | 250 Pot LS Bias |
| R24 | C 4300-7 | 13K |
| R25 | C 2628-3 | 2.2K |
| R26 | C 6844-2 | 250 Pot HS Bias |
| R27 | C 6495-3 | 390 |
| R28 | C 4300-7 | 13K |
| R30* | C 6626-3* | 102* |

Misc.

| | | |
|-----------|----------|-------------------|
| Board | P10315-3 | |
| Jumpers | C 5868-2 | 0 Ohm .25W |
| Clips | D 6414-3 | Q17/Q19 Hold Down |
| J500 J600 | C 7057-0 | 10 Pin Header |

*Note: R30 is 102 Ohms in most units, though in some cases a different value may be used to match the installed S100/S200 LM334 (C5826-0) device grade. This is the standard value and is used with the most common LM334 grade, green. If the LM334 is marked with a blue dot, R30 should be a 107 Ohm resistor (A10265-10701); if it is marked with a yellow dot then R30 should be a 100 Ohm resistor (A10265-10001).

Q42969-8 Output Module (P10337-7 board) Parts List

Capacitors

| | | |
|-----|----------|----------------------|
| C01 | C 8511-5 | .047 μ F 250V Ax |
| C02 | C 8426-6 | .1 μ F |
| C03 | C 8426-6 | .1 μ F |
| C04 | C 6805-3 | .022 μ F |
| C05 | C 6805-3 | .022 μ F |
| C06 | C 6806-1 | .01 μ F 100V Ax |
| C07 | C 6807-9 | .001 μ F 100V Ax |
| C08 | C 6810-3 | 180pF |
| C09 | C 6809-5 | 220pF |
| C10 | C 7697-3 | .01 μ F |
| C11 | C 7697-3 | .01 μ F |
| C43 | C 7697-3 | .01 μ F |

Diodes

| | | |
|-----|----------|--------|
| D01 | C 2851-1 | 1N4004 |
| D02 | C 2851-1 | 1N4004 |
| D03 | C 2851-1 | 1N4004 |
| D04 | C 2851-1 | 1N4004 |
| D05 | C 2851-1 | 1N4004 |
| D06 | C 2851-1 | 1N4004 |
| D07 | C 2851-1 | 1N4004 |
| D08 | C 2851-1 | 1N4004 |
| D09 | C 2851-1 | 1N4004 |
| D10 | C 2851-1 | 1N4004 |
| D11 | C 2851-1 | 1N4004 |
| D12 | C 2851-1 | 1N4004 |

Inductors

| | | |
|-----|----------|-------------------------|
| L00 | C 6592-6 | 1.3 μ H Output Coil |
| L01 | C 3510-2 | 470 μ H |
| L02 | C 3510-2 | 470 μ H |

Transistors

| | | |
|-----|----------|--------------|
| Q17 | C 8508-1 | NPN 2SC3298B |
| Q19 | C 8509-9 | PNP 2SA1306B |

Note: Q18, S100, Driver Transistors, and Output Transistors are not included with the Output Module. See Output Assembly parts list for part numbers.

Resistors

| | | |
|------|---------------|--------------------|
| R00 | A10266-4711 | 470 |
| R01 | A10266-1011 | 100 |
| R04 | C 6486-2 | .2 5W |
| R07 | C 6486-2 | .2 5W |
| R10 | A10266-1011 | 100 |
| R11 | A10266-2R73 | 2.7 1W |
| R12 | A10266-2R73 | 2.7 1W |
| R13 | A10266-4711 | 470 |
| R14 | A10266-2R73 | 2.7 1W |
| R16 | C 6486-2 | .2 5W |
| R19 | C 6486-2 | .2 5W |
| R23 | C 6844-2 | 250 Pot LS Bias |
| R24 | A10266-1331 | 13K |
| R25 | A10266-2221 | 2.2K |
| R26 | C 6844-2 | 250 Pot HS Bias |
| R27 | A10266-3911 | 390 |
| R28 | A10266-1331 | 13K |
| R29 | A10266-5101 | 51 |
| R30* | A10265-10201* | 102* |
| R31 | C 3614-2 | 15 .5W Flame Proof |
| R32 | C 3614-2 | 15 .5W Flame Proof |
| R33 | C 7779-9 | 22 .5W Flame Proof |
| R34 | C 7779-9 | 22 .5W Flame Proof |

Misc.

| | | |
|-----------|----------|-------------------|
| Board | P10337-7 | |
| Jumpers | C 5868-2 | 0 Ohm .25W |
| Clips | D 6414-3 | Q17/Q19 Hold Down |
| J500 J600 | C 7057-0 | 10 Pin Header |

*Note: R30 is 102 Ohms in most units, though in some cases a different value may be used to match the installed S100/S200 LM334 (C5826-0) device grade. This is the standard value and is used with the most common LM334 grade, green. If the LM334 is marked with a blue dot, R30 should be a 107 Ohm resistor (A10265-10701); if it is marked with a yellow dot then R30 should be a 100 Ohm resistor (A10265-10001).

Q43188-4 Output Module (P10396-3 board) Parts List Cont.

Capacitors

| | | |
|-----|----------|----------------|
| C01 | C 8511-5 | .047μF 250V Ax |
| C02 | C 8426-6 | .1μF |
| C03 | C 8426-6 | .1μF |
| C04 | C 6805-3 | .022μF |
| C05 | C 6805-3 | .022μF |
| C06 | C 6806-1 | .01μF 100V Ax |
| C07 | C 6807-9 | .001μF 100V Ax |
| C08 | C 6810-3 | 180pF |
| C09 | C 6809-5 | 220pF |
| C43 | C 7697-3 | .01μF Disc |

Diodes

| | | |
|-----|----------|--------|
| D01 | C 2851-1 | 1N4004 |
| D02 | C 2851-1 | 1N4004 |
| D03 | C 2851-1 | 1N4004 |
| D04 | C 2851-1 | 1N4004 |
| D05 | C 2851-1 | 1N4004 |
| D06 | C 2851-1 | 1N4004 |
| D07 | C 2851-1 | 1N4004 |
| D08 | C 2851-1 | 1N4004 |
| D09 | C 2851-1 | 1N4004 |
| D10 | C 2851-1 | 1N4004 |
| D11 | C 2851-1 | 1N4004 |
| D12 | C 2851-1 | 1N4004 |

Inductors

| | | |
|-----|----------|-------------------|
| L00 | C 6592-6 | 1.3μH Output Coil |
| L01 | C 3510-2 | 470μH |
| L02 | C 3510-2 | 470μH |

Transistors

| | | |
|-----|----------|-------------|
| Q17 | C10155-7 | NPN 2SC4793 |
| Q19 | C10156-5 | PNP 2SA1837 |

Note: Q18, S100, Driver Transistors, and Output Transistors are not included with Output Module. See Output Assembly parts list for part numbers.

Resistors

| | | |
|------|---------------|--------------------|
| R00 | A10266-4711 | 470 |
| R01 | A10266-1011 | 100 |
| R04 | C 6486-2 | .2 5W |
| R07 | C 6486-2 | .2 5W |
| R10 | A10266-1011 | 100 |
| R11 | A10266-2R73 | 2.7 1W |
| R12 | A10266-2R73 | 2.7 1W |
| R13 | A10266-4711 | 470 |
| R14 | A10266-2R73 | 2.7 1W |
| R16 | C 6486-2 | .2 5W |
| R19 | C 6486-2 | .2 5W |
| R23 | C 6844-2 | 250 Pot LS Bias |
| R24 | A10266-1331 | 13K |
| R25 | A10266-2221 | 2.2K |
| R26 | C 6844-2 | 250 Pot HS Bias |
| R27 | A10266-3911 | 390 |
| R28 | A10266-1331 | 13K |
| R29 | A10266-5101 | 51 |
| R30* | A10265-10201* | 102* 1% |
| R31 | C 3614-2 | 15 .5W |
| R32 | C 3614-2 | 15 .5W |
| R33 | C 7779-9 | 22 .5W Flame Proof |
| R34 | C 7779-9 | 22 .5W Flame Proof |

Misc.

| | | |
|-----------|-----------|-------------------|
| Board | P10396-3 | |
| Z1-Z7, Z9 | C 5868-2 | 0 Ohm Jumper |
| Z8 | A10124-24 | Solid Wire |
| Clips | D 6414-3 | Q17/Q19 Hold Down |
| J500 J600 | C 7057-0 | 10 Pin Header |

*Note: R30 is 102 Ohms in most units, though in some cases a different value may be used to match the installed S100/S200 LM334 (C5826-0) device grade. This is the standard value and is used with the most common LM334 grade, green. If the LM334 is marked with a blue dot, R30 should be a 107 Ohm resistor (A10265-10701); if it is marked with a yellow dot then R30 should be a 100 Ohm resistor (A10265-10001).

Q43013-4 Main Module (D 7911-7 board) Parts List

Capacitors

| | | |
|------|---------------|-----------------|
| C1 | C 4303-1 | 1000 μ F |
| C2 | C 3913-8 | 470 μ F |
| C4 | C 6802-0 | .47 μ F |
| C5 | A10124-24 | Jumper Wire |
| C6 | A10124-24 | Jumper Wire |
| C7 | C 8897-8 | .1 μ F |
| C100 | C200 C 5311-3 | 22 μ F |
| C101 | C201 C 2821-4 | 10pF |
| C103 | C203 C 6805-3 | .022 μ F |
| C104 | C204 C 6805-3 | .022 μ F |
| C105 | C205 C 6812-9 | 47pF |
| C106 | C206 C 6812-9 | 47pF |
| C107 | C207 C 6804-6 | .1 μ F |
| C108 | C208 C 6814-5 | 12pF |
| C109 | C209 C 7417-6 | .0033 μ F |
| C110 | C210 C 5362-6 | 2.2 μ F |
| C111 | C211 C 6804-6 | .1 μ F |
| C112 | C212 C 6803-8 | .12 μ F |
| C113 | C213 C 6802-0 | .47 μ F |
| C114 | C214 C 8854-9 | 100 μ F |
| C115 | C215 C 8854-9 | 100 μ F |
| C116 | C216 C 6802-0 | .47 μ F |
| C117 | C217 C 6803-8 | .12 μ F |
| C118 | C218 C 6814-5 | 12pF |
| C119 | C219 C 6802-0 | .47 μ F |
| C120 | C220 C 6804-6 | .1 μ F |
| C122 | C222 C 6811-1 | 100pF |
| C123 | C223 C 6812-9 | 47pF |
| C124 | C224 C 6812-9 | 47pF |
| C129 | C229 C 6814-5 | 12pF |
| C130 | C230 C 6813-7 | 27pF |
| C133 | C233 C 6813-7 | 27pF |
| C134 | C234 C 6805-3 | .022 μ F |
| C135 | C235 C 6805-3 | .022 μ F |
| C136 | C236 C 6808-7 | 470pF |
| C137 | C237 C 6808-7 | 470pF |
| C138 | C238 C 6813-7 | 27pF |
| C139 | C239 C 6813-7 | 27pF |
| C140 | C240 C 6812-9 | 47pF |
| C141 | C241 C 6812-9 | 47pF |
| C144 | C244 C 8576-8 | 100 μ F |
| C145 | C245 C 6812-9 | 47pF |
| C146 | C246 C 6812-9 | 47pF |
| C147 | C247 C 6806-1 | .01 μ F |
| C148 | C248 C 6810-3 | 180pF |
| C149 | C249 C 6808-7 | 470pF |
| C150 | C250 C 6806-1 | .01 μ F |
| C151 | C251 C 6806-1 | .01 μ F |
| C152 | C252 C 6950-7 | 82pF 5% |
| C153 | C253 C 6804-6 | .1 μ F |
| C154 | C254 C 8426-6 | .1 μ F 250V |

| | | | |
|------|------|----------|-------------|
| C155 | C255 | C 6804-6 | .1 μ F |
| C156 | C256 | C 6804-6 | .1 μ F |
| C157 | C257 | C 6806-1 | .01 μ F |

Diodes

| | | | |
|------|------|----------|--------|
| D1 | | C 2851-1 | 1N4004 |
| D2 | | C 2851-1 | 1N4004 |
| D3 | | C 2851-1 | 1N4004 |
| D4 | | C 2851-1 | 1N4004 |
| D5 | | C 2851-1 | 1N4004 |
| D6 | | C 2851-1 | 1N4004 |
| D7 | | C 2851-1 | 1N4004 |
| D108 | D208 | C 3181-2 | 1N4148 |
| D109 | D209 | C 3181-2 | 1N4148 |
| D110 | D210 | C 3181-2 | 1N4148 |
| D111 | D211 | C 5061-4 | 1N3070 |
| D112 | D212 | C 3181-2 | 1N4148 |
| D113 | D213 | C 3181-2 | 1N4148 |
| D120 | D220 | C 3181-2 | 1N4148 |
| D121 | D221 | C 3181-2 | 1N4148 |
| D122 | D222 | C 3181-2 | 1N4148 |
| D123 | D223 | C 5061-4 | 1N3070 |
| D124 | D224 | C 3181-2 | 1N4148 |
| D125 | D225 | C 3181-2 | 1N4148 |
| D126 | D226 | C 5061-4 | 1N3070 |
| D127 | D227 | C 5061-4 | 1N3070 |
| D128 | D228 | C 5061-4 | 1N3070 |
| D129 | D229 | C 3181-2 | 1N4148 |
| D130 | D230 | C 3181-2 | 1N4148 |
| D131 | D231 | C 3181-2 | 1N4148 |
| D132 | D232 | C 3181-2 | 1N4148 |

Transistors

| | | | |
|------|------|----------|-------------|
| Q100 | Q200 | D 2961-7 | NPN 2N3859A |
| Q101 | Q201 | C 3578-9 | PNP MPSA93 |
| Q102 | Q202 | C 3810-6 | NPN MPSA43 |
| Q103 | Q203 | C 3786-8 | PNP PN4250 |
| Q105 | Q205 | C 3578-9 | PNP MPSA93 |
| Q106 | Q206 | C 3625-8 | NPN 2N4125 |
| Q107 | Q207 | C 3786-8 | PNP PN4250 |
| Q108 | Q208 | D 2961-7 | NPN 2N3859A |
| Q109 | Q209 | D 2961-7 | NPN 2N3859A |
| Q110 | Q210 | C 3810-6 | NPN MPSA43 |
| Q112 | Q212 | C 3625-8 | NPN 2N4125 |
| Q113 | Q213 | C 3625-8 | NPN 2N4125 |
| Q115 | Q215 | D 2962-5 | NPN MPS8097 |
| Q116 | Q216 | C 3786-8 | PNP PN4250 |
| Q117 | Q217 | D 2961-7 | NPN 2N3859A |
| Q118 | Q218 | D 2961-7 | NPN 2N3859A |
| Q119 | Q219 | C 3625-8 | NPN 2N4125 |

Q43013-4 Main Module (D 7911-7 board) Parts List

| | | | | | | | |
|------------------|------|--------------|------------------|------|------|--------------|---------------------|
| Q120 | Q220 | C 3625-8 | NPN 2N4125 | R130 | R230 | A10266-1041 | 100K |
| Q121 | Q221 | C 7458-0 | NPN 2N4123 | R131 | R231 | A10266-1031 | 10K |
| Q122 | Q222 | C 7458-0 | NPN 2N4123 | R132 | R232 | C 5062-2 | 100K Pot (+ODEP) |
| Q123 | Q223 | C 7458-0 | NPN 2N4123 | R133 | R233 | A10266-2741 | 270K |
| Q124 | Q224 | C 3625-8 | NPN 2N4125 | R134 | R234 | A10266-2032 | 20K .5W |
| Resistors | | | | R135 | R235 | C 7782-3 | 100 Flame Proof |
| | | | | R136 | R236 | A10266-6821 | 6.8K |
| | | | | R137 | R237 | C 7782-3 | 100 Flame Proof |
| | | | | R138 | R238 | A10266-6821 | 6.8K |
| N100 | N200 | D 4669-4 | Resistor Network | R139 | R239 | A10266-8211 | 820 |
| N101 | N201 | D 6081-0 | Resistor Network | R140 | R240 | A10266-6801 | 68 |
| N102 | N202 | D 6082-8 | Resistor Network | R141 | R241 | A10266-1541 | 150K |
| R1 | | A10265-53621 | 53.6K 1% | R142 | R242 | A10266-1541 | 150K |
| R2 | | OPEN | | R143 | R243 | A10266-1041 | 100K |
| R3 | | OPEN | | R144 | R244 | A10266-1041 | 100K |
| R4 | | A10265-46421 | 46.4K 1% | R145 | R245 | A10266-1851 | 1.8M |
| R7 | | A10266-1041 | 100K | R146 | R246 | A10266-1031 | 10K |
| R8 | | A10266-2031 | 20K | R147 | R247 | C 7781-5 | 200 .5W Flame Proof |
| R9 | | A10266-5121 | 5.1K | R148 | R248 | A10266-2721 | 2.7K |
| R16 | | A10266-5121 | 5.1K | R149 | R249 | C 7781-5 | 200 .5W Flame Proof |
| R17 | | A10266-2031 | 20K | R150 | R250 | A10266-2721 | 2.7K |
| R18 | | A10266-1041 | 100K | R151 | R251 | A10266-1031 | 10K |
| R100 | R200 | C 7409-3 | 5K Linear Pot | R152 | R252 | A10266-1231 | 12K |
| R101 | R201 | A10265-49911 | 4.99K 1% | R153 | R253 | JUMPER | A10124-24 |
| R102 | R202 | A10266-5111 | 510 | R154 | R254 | A10265-12131 | 121K 1% |
| R103 | R203 | A10265-10031 | 100K 1% | R155 | R255 | A10266-1321 | 1.3K |
| R104 | R204 | A10266-2721 | 2.7K | R156 | R256 | A10266-1321 | 1.3K |
| R105 | R205 | A10266-2721 | 2.7K | R157 | R257 | A10266-1321 | 1.3K |
| R106 | R206 | A10266-1231 | 12K | R158 | R258 | A10266-9121 | 9.1K |
| R107 | R207 | A10266-6831 | 68K | R159 | R259 | A10266-1021 | 1K |
| R108 | R208 | A10266-8211 | 820 | R160 | R260 | C 8260-9 | 10K 0.1% |
| R109 | R209 | A10266-6801 | 68 | R161 | R261 | A10266-4701 | 47 |
| R110 | R210 | A10266-6831 | 68K | R162 | R262 | A10266-4701 | 47 |
| R111 | R211 | A10266-1231 | 12K | R163 | R263 | A10265-12131 | 121K 1% |
| R112 | R212 | A10266-5131 | 51K | R164 | R264 | A10265-10021 | 10K 1% |
| R113 | R213 | A10266-4721 | 4.7K | R165 | R265 | A10265-12131 | 121K 1% |
| R114 | R214 | A10266-4721 | 4.7K | R166 | R266 | A10266-1851 | 1.8M |
| R115 | R215 | A10266-5141 | 510K | R167 | R267 | A10265-10011 | 1K 1% |
| R116 | R216 | A10266-2751 | 2.7M | R168 | R268 | A10265-95301 | 953 1% |
| R117 | R217 | A10266-4731 | 47K | R170 | R270 | A10265-10011 | 1K 1% |
| R118 | R218 | A10266-2711 | 270 | R171 | R271 | A10265-95301 | 953 1% |
| R119 | R219 | A10266-3911 | 390 | R173 | R273 | A10265-10021 | 10K 1% |
| R120 | R220 | A10266-2711 | 270 | R174 | R274 | A10265-24921 | 24.9K 1% |
| R121 | R221 | C 5062-2 | 100K Pot (-ODEP) | R175 | R275 | A10265-28721 | 28.7K 1% |
| R122 | R222 | A10266-2741 | 270K | R176 | R276 | A10265-24921 | 24.9K 1% |
| R123 | R223 | A10266-2032 | 20K .5W | R177 | R277 | A10265-69811 | 6.98K 1% |
| R124 | R224 | A10266-6821 | 6.8K | R179 | R279 | A10266-1321 | 1.3K |
| R125 | R225 | C 7782-3 | 100 Flame Proof | R180 | R280 | A10266-4711 | 470 |
| R126 | R226 | C 7782-3 | 100 Flame Proof | R181 | R281 | A10266-4721 | 4.7K |
| R127 | R227 | A10266-6821 | 6.8K | R182 | R282 | A10266-2201 | 22 |
| R128 | R228 | A10266-1031 | 10K | R183 | R283 | A10266-2421 | 2.4K |
| R129 | R229 | A10266-1041 | 100K | R184 | R284 | A10266-4741 | 470K |

Q43013-4 Main Module (D 7911-7 board) Parts List

| | | | | | | | |
|------|-------|-------------|------|-----------------|------|-------------|---------------------|
| R185 | R285 | A10266-2421 | 2.4K | | | | |
| R186 | R286 | A10266-2751 | 2.7M | | | | |
| R187 | R287 | A10266-3631 | 36K | | | | |
| R188 | R288 | A10266-3631 | 36K | | | | |
| R189 | R289 | A10266-2731 | 27K | | | | |
| R190 | R290 | A10266-2051 | 2M | | | | |
| R191 | R291 | A10266-3331 | 33K | | | | |
| R192 | R292 | A10266-1031 | 10K | | | | |
| R193 | R293 | A10266-1031 | 10K | | | | |
| R194 | R294 | A10266-1041 | 100K | | | | |
| R195 | R295 | A10266-3021 | 3K | | | | |
| R196 | R296 | A10266-4721 | 4.7K | | | | |
| R197 | R297 | A10266-1031 | 10K | | | | |
| R198 | R298 | A10266-4721 | 4.7K | | | | |
| R199 | R299 | A10266-1031 | 10K | | | | |
| R906 | R1006 | OPEN | | | | | |
| R907 | R1007 | OPEN | | | | | |
| R908 | R1008 | OPEN | | | | | |
| R909 | R1009 | A10266-4741 | 470K | | | | |
| R910 | R1010 | A10266-4741 | 470K | | | | |
| R911 | R1011 | A10266-1521 | 1.5K | | | | |
| R912 | R1012 | A10266-4711 | 470 | | | | |
| R913 | R1013 | A10266-1051 | 1M | | | | |
| R914 | R1014 | A10266-1051 | 1M | | | | |
| R915 | R1015 | A10266-2201 | 22 | | | | |
| R916 | R1016 | A10266-2201 | 22 | | | | |
| | | | | Switches | | | |
| | | | | S2 | | OPEN | |
| | | | | S3 | | C 7960-5 | Sensitivity |
| | | | | S4 | | C 6781-6 | Switch, Stereo/Mono |
| | | | | IC's | | | |
| | | | | U1 | | C 5095-2 | UA7815 |
| | | | | U2 | | C 5096-0 | UA7915 |
| | | | | U100 | U200 | C 6911-9 | UPA75 |
| | | | | U101 | U201 | C 4345-2 | LM339 |
| | | | | U102 | U202 | C 4345-2 | LM339 |
| | | | | U103 | U203 | C 6910-1 | UPA76 |
| | | | | U104 | U204 | C 7558-7 | MC33079P |
| | | | | Misc. | | | |
| | | | | Board | | D 7911-7 | |
| | | | | Socket | | C 3450-1 | 14 Pin (Qty 6) |
| | | | | Nut | | A10102-5 | Hex 6-32 (Qty 2) |
| | | | | Heatsink | | C 5341-0 | TO-220 (Qty 2) |
| | | | | Torq Spreader | | C 6541-4 | (Qty 2) |
| | | | | Washer | | A10096-5 | #6, Split (Qty 2) |
| | | | | Screw | | A10240-0608 | Stainless (Qty 2) |
| | | | | J1 | | C 7593-4 | 5 Pin Header |
| | | | | J2 | | C 4508-5 | 16 Pin Socket |
| | | | | J3 | | C 7526-4 | 3 Pin Header |
| | | | | J100 | J200 | OPEN | |
| | | | | J500 | J800 | D 6619-7 | 10 Inch Ribbon |
| | | | | J600 | J700 | D 6620-5 | 6 Inch Ribbon |
| | | | | Cable Tie | | C 1811-6 | (Qty 4) |

Q43044-9 Main Module (D 7993-5 board) Parts List

Capacitors

| | | |
|-----------|-----------|-------------|
| C1 | C 4303-1 | 1000μF |
| C2 | C 3913-8 | 470μF |
| C4 | C 6802-0 | .47μF |
| C5 | A10124-24 | Jumper Wire |
| C6 | A10124-24 | Jumper Wire |
| C7 | C 8897-8 | .1μF |
| C100 C200 | C 5311-3 | 22μF |
| C101 C201 | C 2821-4 | 10pF |
| C103 C203 | C 6805-3 | .022μF |
| C104 C204 | C 6805-3 | .022μF |
| C105 C205 | C 6812-9 | 47pF |
| C106 C206 | C 6812-9 | 47pF |
| C107 C207 | C 8897-8 | .1μF |
| C108 C208 | C 6814-5 | 12pF |
| C109 C209 | C 7417-6 | .0033μF |
| C110 C210 | C 5362-6 | 2.2μF |
| C111 C211 | C 8897-8 | .1μF |
| C112 C212 | C 8991-9 | .47μF |
| C113 C213 | C 8987-7 | 22μF |
| C114 C214 | C 8854-9 | 100μF |
| C115 C215 | C 8854-9 | 100μF |
| C116 C216 | C 8987-7 | 22μF |
| C117 C217 | C 8991-9 | .47μF |
| C118 C218 | C 6814-5 | 12pF |
| C119 C219 | C 6802-0 | .47μF |
| C120 C220 | C 8897-8 | .1μF |
| C122 C222 | C 6811-1 | 100pF |
| C123 C223 | C 6812-9 | 47pF |
| C124 C224 | C 6812-9 | 47pF |
| C129 C229 | C 6814-5 | 12pF |
| C130 C230 | C 6813-7 | 27pF |
| C133 C233 | C 6813-7 | 27pF |
| C134 C234 | C 6805-3 | .022μF |
| C135 C235 | C 6805-3 | .022μF |
| C136 C236 | C 6808-7 | 470pF |
| C137 C237 | C 6808-7 | 470pF |
| C138 C238 | C 6813-7 | 27pF |
| C139 C239 | C 6813-7 | 27pF |
| C140 C240 | C 6812-9 | 47pF |
| C141 C241 | C 6812-9 | 47pF |
| C144 C244 | C 8576-8 | 100μF |
| C145 C245 | C 6812-9 | 47pF |
| C146 C246 | C 6812-9 | 47pF |
| C147 C247 | C 6806-1 | .01μF |
| C148 C248 | C 6810-3 | 180pF |
| C149 C249 | C 6808-7 | 470pF |
| C150 C250 | C 6806-1 | .01μF |
| C151 C251 | C 6806-1 | .01μF |
| C152 C252 | C 6950-7 | 82pF 5% |
| C153 C253 | C 8897-8 | .1μF |
| C154 C254 | C 8426-6 | .1μF 250V |

| | | | |
|------|------|----------|-------|
| C155 | C255 | C 8897-8 | .1μF |
| C156 | C256 | C 8897-8 | .1μF |
| C157 | C257 | C 6806-1 | .01μF |

Diodes

| | | | |
|-----------|--|----------|--------|
| D1 | | C 2851-1 | 1N4004 |
| D2 | | C 2851-1 | 1N4004 |
| D3 | | C 2851-1 | 1N4004 |
| D4 | | C 2851-1 | 1N4004 |
| D5 | | C 2851-1 | 1N4004 |
| D6 | | C 2851-1 | 1N4004 |
| D7 | | C 2851-1 | 1N4004 |
| D108 D208 | | C 3181-2 | 1N4148 |
| D109 D209 | | C 3181-2 | 1N4148 |
| D110 D210 | | C 3181-2 | 1N4148 |
| D111 D211 | | C 5061-4 | 1N3070 |
| D112 D212 | | C 3181-2 | 1N4148 |
| D113 D213 | | C 3181-2 | 1N4148 |
| D114 D214 | | OPEN | |
| D115 D215 | | OPEN | |
| D120 D220 | | C 3181-2 | 1N4148 |
| D121 D221 | | C 3181-2 | 1N4148 |
| D122 D222 | | C 3181-2 | 1N4148 |
| D123 D223 | | C 5061-4 | 1N3070 |
| D124 D224 | | C 3181-2 | 1N4148 |
| D125 D225 | | C 3181-2 | 1N4148 |
| D126 D226 | | C 5061-4 | 1N3070 |
| D127 D227 | | C 5061-4 | 1N3070 |
| D128 D228 | | C 5061-4 | 1N3070 |
| D129 D229 | | C 3181-2 | 1N4148 |
| D130 D230 | | C 3181-2 | 1N4148 |
| D131 D231 | | C 3181-2 | 1N4148 |
| D132 D232 | | C 3181-2 | 1N4148 |

Transistors

| | | |
|-----------|----------|-------------|
| Q100 Q200 | D 2961-7 | NPN 2N3859A |
| Q101 Q201 | C 3578-9 | PNP MPSA93 |
| Q102 Q202 | C 3810-6 | NPN MPSA43 |
| Q103 Q203 | C 3786-8 | PNP PN4250 |
| Q105 Q205 | C 3578-9 | PNP MPSA93 |
| Q106 Q206 | C 3625-8 | NPN 2N4125 |
| Q107 Q207 | C 3786-8 | PNP PN4250 |
| Q108 Q208 | D 2961-7 | NPN 2N3859A |
| Q109 Q209 | D 2961-7 | NPN 2N3859A |
| Q110 Q210 | C 3810-6 | NPN MPSA43 |
| Q112 Q212 | C 3625-8 | NPN 2N4125 |
| Q113 Q213 | C 3625-8 | NPN 2N4125 |
| Q115 Q215 | D 2962-5 | NPN MPS8097 |
| Q116 Q216 | C 3786-8 | PNP PN4250 |
| Q117 Q217 | D 2961-7 | NPN 2N3859A |

Q43128-0 Main Module (D8283-0 board) Parts List

Capacitors

| | | |
|------|---------------|-----------------|
| C1 | C 4303-1 | 1000 μ F |
| C2 | C 3913-8 | 470 μ F |
| C4 | C 6802-0 | .47 μ F |
| C5 | A10124-24 | Jumper Wire |
| C6 | A10124-24 | Jumper Wire |
| C7 | C 8897-8 | .1 μ F |
| C100 | C200 C 5311-3 | 22 μ F |
| C101 | C201 C 9464-6 | 10pF |
| C103 | C203 C 6805-3 | .022 μ F |
| C104 | C204 C 6805-3 | .022 μ F |
| C105 | C205 C 6812-9 | 47pF |
| C106 | C206 C 6812-9 | 47pF |
| C107 | C207 C 8897-8 | .1 μ F |
| C108 | C208 C 6814-5 | 12pF |
| C109 | C209 C 7417-6 | .0033 μ F |
| C110 | C210 C 5362-6 | 2.2 μ F |
| C111 | C211 C 8897-8 | .1 μ F |
| C112 | C212 C 8991-9 | .47 μ F |
| C113 | C213 C 8987-7 | 22 μ F |
| C114 | C214 C 8854-9 | 100 μ F |
| C115 | C215 C 8854-9 | 100 μ F |
| C116 | C216 C 8987-7 | 22 μ F |
| C117 | C217 C 8991-9 | .47 μ F |
| C118 | C218 C 6814-5 | 12pF |
| C119 | C219 C 6802-0 | .47 μ F |
| C120 | C220 C 8897-8 | .1 μ F |
| C122 | C222 C 6811-1 | 100pF |
| C123 | C223 C 6812-9 | 47pF |
| C124 | C224 C 6812-9 | 47pF |
| C129 | C229 C 6814-5 | 12pF |
| C130 | C230 C 6813-7 | 27pF |
| C133 | C233 C 6813-7 | 27pF |
| C134 | C234 C 6805-3 | .022 μ F |
| C135 | C235 C 6805-3 | .022 μ F |
| C136 | C236 C 6808-7 | 470pF |
| C137 | C237 C 6808-7 | 470pF |
| C138 | C238 C 6813-7 | 27pF |
| C139 | C239 C 6813-7 | 27pF |
| C140 | C240 C 6812-9 | 47pF |
| C141 | C241 C 6812-9 | 47pF |
| C144 | C244 C 8576-8 | 100 μ F |
| C145 | C245 C 6812-9 | 47pF |
| C146 | C246 C 6812-9 | 47pF |
| C147 | C247 C 6806-1 | .01 μ F |
| C148 | C248 C 6810-3 | 180pF |
| C149 | C249 C 6808-7 | 470pF |
| C150 | C250 C 6806-1 | .01 μ F |
| C151 | C251 C 6806-1 | .01 μ F |
| C152 | C252 C 6950-7 | 82pF 5% |
| C153 | C253 C 8897-8 | .1 μ F |
| C154 | C254 C 8426-6 | .1 μ F 250V |

| | | | |
|------|------|----------|--------------|
| C155 | C255 | C 8897-8 | .1 μ F |
| C156 | C256 | C 8897-8 | .1 μ F |
| C157 | C257 | C 6806-1 | .01 μ F |
| C158 | C258 | C 6807-9 | .001 μ F |
| C159 | C259 | C 6807-9 | .001 μ F |
| C160 | C260 | C 6811-1 | 100pF |
| C161 | C261 | C 6811-1 | 100pF |

Diodes

| | | | |
|------|------|----------|--------|
| D1 | | C 2851-1 | 1N4004 |
| D2 | | C 2851-1 | 1N4004 |
| D3 | | C 2851-1 | 1N4004 |
| D4 | | C 2851-1 | 1N4004 |
| D5 | | C 2851-1 | 1N4004 |
| D6 | | C 2851-1 | 1N4004 |
| D7 | | C 2851-1 | 1N4004 |
| D108 | D208 | C 3181-2 | 1N4148 |
| D109 | D209 | C 3181-2 | 1N4148 |
| D110 | D210 | C 3181-2 | 1N4148 |
| D111 | D211 | C 5061-4 | 1N3070 |
| D112 | D212 | C 3181-2 | 1N4148 |
| D113 | D213 | C 3181-2 | 1N4148 |
| D114 | D214 | C 3181-2 | 1N4148 |
| D115 | D215 | C 3181-2 | 1N4148 |
| D120 | D220 | C 3181-2 | 1N4148 |
| D121 | D221 | C 3181-2 | 1N4148 |
| D122 | D222 | C 3181-2 | 1N4148 |
| D123 | D223 | C 5061-4 | 1N3070 |
| D124 | D224 | C 3181-2 | 1N4148 |
| D125 | D225 | C 3181-2 | 1N4148 |
| D126 | D226 | C 5061-4 | 1N3070 |
| D127 | D227 | C 5061-4 | 1N3070 |
| D128 | D228 | C 5061-4 | 1N3070 |
| D129 | D229 | C 3181-2 | 1N4148 |
| D130 | D230 | C 3181-2 | 1N4148 |
| D131 | D231 | C 3181-2 | 1N4148 |
| D132 | D232 | C 3181-2 | 1N4148 |
| D133 | D233 | C 3181-2 | 1N4148 |
| D134 | D234 | C 3181-2 | 1N4148 |

Transistors

| | | | |
|------|------|----------|-------------|
| Q100 | Q200 | D 2961-7 | NPN 2N3859A |
| Q101 | Q201 | C 3578-9 | PNP MPSA93 |
| Q102 | Q202 | C 3810-6 | NPN MPSA43 |
| Q103 | Q203 | C 3786-8 | PNP PN4250 |
| Q105 | Q205 | C 3578-9 | PNP MPSA93 |
| Q106 | Q206 | C 3625-8 | NPN 2N4125 |
| Q107 | Q207 | C 3786-8 | PNP PN4250 |
| Q108 | Q208 | C 5891-4 | NPN MTS105 |
| Q109 | Q209 | D 2961-7 | NPN 2N3859A |
| Q110 | Q210 | C 3810-6 | NPN MPSA43 |
| Q112 | Q212 | C 3625-8 | NPN 2N4125 |

Q43128-0 Main Module (D8283-0 board) Parts List

| | | | | | | | |
|------|------|----------|-------------|------|------|--------------|---------------------|
| Q113 | Q213 | C 3625-8 | NPN 2N4125 | R126 | R226 | C 7782-3 | 100 Flame Proof |
| Q115 | Q215 | D 2962-5 | NPN MPS8097 | R127 | R227 | A10266-6821 | 6.8K |
| Q116 | Q216 | C 3786-8 | PNP PN4250 | R128 | R228 | A10266-1331 | 13K |
| Q117 | Q217 | D 2961-7 | NPN 2N3859A | R129 | R229 | A10266-1041 | 100K |
| Q118 | Q218 | D 2961-7 | NPN 2N3859A | R130 | R230 | A10266-1041 | 100K |
| Q119 | Q219 | C 3625-8 | NPN 2N4125 | R131 | R231 | A10266-1331 | 13K |
| Q120 | Q220 | C 3625-8 | NPN 2N4125 | R132 | R232 | C 5062-2 | 100K Pot (+ODEP) |
| Q121 | Q221 | C 7458-0 | NPN 2N4123 | R133 | R233 | A10266-2741 | 270K |
| Q122 | Q222 | C 7458-0 | NPN 2N4123 | R134 | R234 | A10266-2032 | 20K .5W |
| Q123 | Q223 | C 7458-0 | NPN 2N4123 | R135 | R235 | C 7782-3 | 100 Flame Proof |
| Q124 | Q224 | C 3625-8 | NPN 2N4125 | R136 | R236 | A10266-6821 | 6.8K |
| Q125 | Q225 | C 3786-8 | PNP PN4250A | R137 | R237 | C 7782-3 | 100 Flame Proof |
| Q126 | Q226 | C 5891-4 | NPN MTS105 | R138 | R238 | A10266-6821 | 6.8K |
| | | | | R139 | R239 | A10266-8211 | 820 |
| | | | | R140 | R240 | A10266-5601 | 56 |
| | | | | R141 | R241 | A10266-1541 | 150K |
| | | | | R142 | R242 | A10266-1541 | 150K |
| | | | | R143 | R243 | A10266-1041 | 100K |
| | | | | R144 | R244 | A10266-1041 | 100K |
| | | | | R145 | R245 | A10266-2251 | 2.2M |
| | | | | R146 | R246 | A10266-1031 | 10K |
| | | | | R147 | R247 | C 7781-5 | 200 .5W Flame Proof |
| | | | | R148 | R248 | A10266-2721 | 2.7K |
| | | | | R149 | R249 | C 7781-5 | 200 .5W Flame Proof |
| | | | | R150 | R250 | A10266-2721 | 2.7K |
| | | | | R151 | R251 | A10266-1031 | 10K |
| | | | | R152 | R252 | A10265-11821 | 11.8K 1% |
| | | | | R153 | R253 | JUMPER | A10124-24 |
| | | | | R154 | R254 | C 8261-7 | 121K 0.1% |
| | | | | R155 | R255 | A10266-1321 | 1.3K |
| | | | | R156 | R256 | A10266-1321 | 1.3K |
| | | | | R157 | R257 | A10266-1321 | 1.3K |
| | | | | R158 | R258 | A10265-11521 | 11.5K 1% |
| | | | | R159 | R259 | A10266-1021 | 1K |
| | | | | R160 | R260 | C 8260-9 | 10K 0.1% |
| | | | | R161 | R261 | A10266-4701 | 47 |
| | | | | R162 | R262 | A10266-4701 | 47 |
| | | | | R163 | R263 | C 8261-7 | 121K 0.1% |
| | | | | R164 | R264 | C 8260-9 | 10K 0.1% |
| | | | | R165 | R265 | C 8261-7 | 121K 0.1% |
| | | | | R166 | R266 | A10266-2251 | 2.2M |
| | | | | R167 | R267 | A10265-10011 | 1K 1% |
| | | | | R168 | R268 | A10265-10011 | 1K 1% |
| | | | | R170 | R270 | A10265-10011 | 1K 1% |
| | | | | R171 | R271 | A10265-10011 | 1K 1% |
| | | | | R173 | R273 | C 8260-9 | 10K 0.1% |
| | | | | R174 | R274 | A10265-24921 | 24.9K 1% |
| | | | | R175 | R275 | A10265-28721 | 28.7K 1% |
| | | | | R176 | R276 | A10265-24921 | 24.9K 1% |
| | | | | R177 | R277 | A10265-69811 | 6.98K 1% |
| | | | | R179 | R279 | A10266-1321 | 1.3K |
| | | | | R180 | R280 | A10266-4711 | 470 |

Resistors

| | | | |
|------|------|--------------|------------------|
| R1 | | A10265-53621 | 53.6K 1% |
| R2 | | OPEN | |
| R3 | | OPEN | |
| R4 | | A10265-46421 | 46.4K 1% |
| R7 | | A10266-1041 | 100K |
| R8 | | A10266-2031 | 20K |
| R9 | | A10266-5121 | 5.1K |
| R10 | | OPEN | |
| R16 | | A10266-5121 | 5.1K |
| R17 | | A10266-2031 | 20K |
| R18 | | A10266-1041 | 100K |
| R100 | R200 | C 7409-3 | 5K Linear Pot |
| R101 | R201 | A10265-49911 | 4.99K 1% |
| R102 | R202 | A10266-5111 | 510 |
| R103 | R203 | A10265-10031 | 100K 1% |
| R104 | R204 | A10266-2721 | 2.7K |
| R105 | R205 | A10266-2721 | 2.7K |
| R106 | R206 | A10266-1231 | 12K |
| R107 | R207 | A10266-6831 | 68K |
| R108 | R208 | A10266-8211 | 820 |
| R109 | R209 | A10266-5601 | 56 |
| R110 | R210 | A10266-6831 | 68K |
| R111 | R211 | A10266-1231 | 12K |
| R112 | R212 | A10266-5131 | 51K |
| R113 | R213 | A10266-4721 | 4.7K |
| R114 | R214 | A10266-4721 | 4.7K |
| R115 | R215 | A10266-5141 | 510K |
| R116 | R216 | A10266-2751 | 2.7M |
| R117 | R217 | A10266-4731 | 47K |
| R118 | R218 | A10265-27401 | 274 1% |
| R119 | R219 | A10265-66501 | 665 1% |
| R120 | R220 | A10265-28701 | 287 1% |
| R121 | R221 | C 5062-2 | 100K Pot (-ODEP) |
| R122 | R222 | A10266-2741 | 270K |
| R123 | R223 | A10266-2032 | 20K .5W |
| R124 | R224 | A10266-6821 | 6.8K |
| R125 | R225 | C 7782-3 | 100 Flame Proof |

Q43128-0 Main Module (D8283-0 board) Parts List

| | | | | | | | |
|--------------------------|-------|--------------|--------------------|----------------------------|-------------|----------------------|----------------|
| R181 | R281 | A10266-4721 | 4.7K | | | | |
| R182 | R282 | A10266-2201 | 22 | | | | |
| R183 | R283 | A10266-2421 | 2.4K | | | | |
| R184 | R284 | A10266-4741 | 470K | | | | |
| R185 | R285 | A10266-2421 | 2.4K | | | | |
| R186 | R286 | A10266-2751 | 2.7M | | | | |
| R187 | R287 | A10266-3631 | 36K | | | | |
| R188 | R288 | A10266-3631 | 36K | | | | |
| R189 | R289 | A10266-2731 | 27K | | | | |
| R190 | R290 | A10266-2051 | 2M | | | | |
| R191 | R291 | A10266-3331 | 33K | | | | |
| R192 | R292 | A10266-1031 | 10K | | | | |
| R193 | R293 | A10266-1031 | 10K | | | | |
| R194 | R294 | A10266-1041 | 100K | | | | |
| R195 | R295 | A10266-3021 | 3K | | | | |
| R196 | R296 | A10266-4721 | 4.7K | | | | |
| R197 | R297 | A10266-1031 | 10K | | | | |
| R198 | R298 | A10266-4721 | 4.7K | | | | |
| R199 | R299 | A10266-1031 | 10K | | | | |
| R906 | R1006 | OPEN | | | | | |
| R907 | R1007 | OPEN | | | | | |
| R908 | R1008 | OPEN | | | | | |
| R909 | R1009 | A10266-4741 | 470K | | | | |
| R910 | R1010 | A10266-4741 | 470K | | | | |
| R911 | R1011 | A10266-1521 | 1.5K | | | | |
| R912 | R1012 | A10266-4711 | 470 | | | | |
| R913 | R1013 | A10266-1051 | 1M | | | | |
| R914 | R1014 | A10266-1051 | 1M | | | | |
| R915 | R1015 | A10266-2201 | 22 | | | | |
| R916 | R1016 | A10266-2201 | 22 | | | | |
| R917 | R1017 | A10265-10021 | 10K 1% | | | | |
| R918 | R1018 | A10265-10021 | 10K 1% | | | | |
| R919 | R1019 | A10265-10021 | 10K 1% | | | | |
| R920 | R1020 | A10265-10021 | 10K 1% | | | | |
| R921 | R1021 | C 9079-2 | 200 Pot (CMR Null) | | | | |
| R922 | R1022 | A10265-66501 | 665 1% | | | | |
| R923 | R1023 | A10265-35711 | 3.57K 1% | | | | |
| R924 | R1024 | A10265-66501 | 665 1% | | | | |
| R925 | R1025 | A10265-10031 | 100K 1% | | | | |
| R926 | R1026 | A10265-66501 | 665 1% | | | | |
| R927 | R1027 | A10265-10031 | 100K 1% | | | | |
| R928 | R1028 | A10265-35711 | 3.57K 1% | | | | |
| R929 | R1029 | A10266-1041 | 100K | | | | |
| R930 | R1030 | A10266-1041 | 100K | | | | |
| Resistor Networks | | | | | | | |
| N101 | N201 | D 7945-5 | Resistor Network | | | | |
| N102 | N202 | D 6082-8 | Resistor Network | | | | |
| | | | | Switches | | | |
| | | | | S2 | OPEN | | |
| | | | | S3 | C 7960-5 | Sensitivity | |
| | | | | S4 | C 6781-6 | Switch, Stereo/Mono | |
| | | | | Integrated Circuits | | | |
| | | | | U1 | C 5095-2 | UA7815 | |
| | | | | U2 | C 5096-0 | UA7915 | |
| | | | | U100 | U200 | C 6911-9 | UPA75 |
| | | | | U101 | U201 | C 4345-2 | LM339 |
| | | | | U102 | U202 | C 4345-2 | LM339 |
| | | | | U103 | U203 | C 6910-1 | UPA76 |
| | | | | U104 | U204 | C 7558-7 | MC33079P |
| | | | | Misc. | | | |
| | | | | Board | D 8283-0 | | |
| | | | | Socket | C 3450-1 | 14 Pin (Qty 6) | |
| | | | | Nut | A10102-5 | Hex 6-32 (Qty 2) | |
| | | | | Heatsink | C 5341-0 | TO-220 (Qty 2) | |
| | | | | Tq Spreader | C 6541-4 | (Qty 2) | |
| | | | | Washer | A10096-5 | #6, Split (Qty 2) | |
| | | | | Screw | A10240-0608 | Stainless (Qty 2) | |
| | | | | J1 | C 7593-4 | 5 Pin Header | |
| | | | | J2 | C 4508-5 | 16 Pin Socket | |
| | | | | J11 | C 7526-4 | 3 Pin Header | |
| | | | | J100 | J200 | OPEN | |
| | | | | J500 | J800 | D 6619-7 | 10 Inch Ribbon |
| | | | | J600 | J700 | D 6620-5 | 6 Inch Ribbon |
| | | | | Cable Tie | C 1811-6 | (Qty 4) | |
| | | | | TP 1 | C 9450-5 | Header, 6 pin RT Ang | |
| | | | | Spacer | C 9225-1 | Plastic Spcr (Qty 5) | |

Q43237-9 Main Module (D 8369-7 board) Parts List

Capacitors

| | | |
|------|-------------------|-------------|
| C1 | C 9859-7 | 1000μF |
| C2 | C 9859-7 | 1000μF |
| C4 | C 6802-0 | .47μF |
| C5 | A10124-24 | Jumper Wire |
| C6 | A10124-24 | Jumper Wire |
| C7 | C 8897-8 | .1μF |
| C100 | C200 C 5311-3 | 22μF |
| C101 | C201 C 9464-6 | 10pF |
| C103 | C203 C 6805-3 | .022μF |
| C104 | C204 C 6805-3 | .022μF |
| C105 | C205 C 6812-9 | 47pF |
| C106 | C206 C 6812-9 | 47pF |
| C107 | C207 C 8897-8 | .1μF |
| C108 | C208 C 6814-5 | 12pF |
| C109 | C209 C 7417-6 | .0033μF |
| C110 | C210 C 5362-6 | 2.2μF |
| C111 | C211 C 8897-8 | .1μF |
| C112 | C212 C 8991-9 | .47μF |
| C113 | C213 C 8987-7 | 22μF |
| C114 | C214 C 8854-9 | 100μF |
| C115 | C215 C 8854-9 | 100μF |
| C116 | C216 C 8987-7 | 22μF |
| C117 | C217 C 8991-9 | .47μF |
| C118 | C218 C 6814-5 | 12pF |
| C119 | C219 C 6802-0 | .47μF |
| C120 | C220 C 8897-8 | .1μF |
| C122 | C222 C 6811-1 | 100pF |
| C123 | C223 C 6812-9 | 47pF |
| C124 | C224 C 6812-9 | 47pF |
| C129 | C229 C 6814-5 | 12pF |
| C130 | C230 C 6813-7 | 27pF |
| C133 | C233 C 6813-7 | 27pF |
| C134 | C234 C 6805-3 | .022μF |
| C135 | C235 C 6805-3 | .022μF |
| C136 | C236 C 6808-7 | 470pF |
| C137 | C237 C 6808-7 | 470pF |
| C138 | C238 C 6813-7 | 27pF |
| C139 | C239 C 6813-7 | 27pF |
| C140 | C240 C 6812-9 | 47pF |
| C141 | C241 C 6812-9 | 47pF |
| C144 | C244 C 8576-8 | 100μF |
| C145 | C245 C 6812-9 | 47pF |
| C146 | C246 C 6812-9 | 47pF |
| C147 | C247 C 6806-1 | .01μF |
| C148 | C248 C 6810-3 | 180pF |
| C149 | C249 C 6808-7 | 470pF |
| C150 | C250 C 6806-1 | .01μF |
| C151 | C251 C 6806-1 | .01μF |
| C152 | C252 C 6950-7 | 82pF 5% |
| C153 | C253 C 8897-8 | .1μF |
| C154 | C254 A10434-104JD | .1μF 250V |

| | | | |
|------|------|----------|--------|
| C155 | C255 | C 8897-8 | .1μF |
| C156 | C256 | C 8897-8 | .1μF |
| C157 | C257 | C 6806-1 | .01μF |
| C158 | C258 | C 6805-3 | .022μF |
| C159 | C259 | C 6805-3 | .022μF |
| C160 | C260 | C 6811-1 | 100pF |
| C161 | C261 | C 6811-1 | 100pF |

Diodes

| | | | |
|------|------|----------|--------|
| D1 | | C 2851-1 | 1N4004 |
| D2 | | C 2851-1 | 1N4004 |
| D3 | | C 2851-1 | 1N4004 |
| D4 | | C 2851-1 | 1N4004 |
| D5 | | C 2851-1 | 1N4004 |
| D6 | | C 2851-1 | 1N4004 |
| D7 | | C 2851-1 | 1N4004 |
| D108 | D208 | C 3181-2 | 1N4148 |
| D109 | D209 | C 3181-2 | 1N4148 |
| D110 | D210 | C 3181-2 | 1N4148 |
| D111 | D211 | C 5061-4 | 1N3070 |
| D112 | D212 | C 3181-2 | 1N4148 |
| D113 | D213 | C 3181-2 | 1N4148 |
| D114 | D214 | C 3181-2 | 1N4148 |
| D115 | D215 | C 3181-2 | 1N4148 |
| D120 | D220 | C 3181-2 | 1N4148 |
| D121 | D221 | C 3181-2 | 1N4148 |
| D122 | D222 | C 3181-2 | 1N4148 |
| D123 | D223 | C 5061-4 | 1N3070 |
| D124 | D224 | C 3181-2 | 1N4148 |
| D125 | D225 | C 3181-2 | 1N4148 |
| D126 | D226 | C 5061-4 | 1N3070 |
| D127 | D227 | C 5061-4 | 1N3070 |
| D128 | D228 | C 5061-4 | 1N3070 |
| D129 | D229 | C 3181-2 | 1N4148 |
| D130 | D230 | C 3181-2 | 1N4148 |
| D131 | D231 | C 3181-2 | 1N4148 |
| D132 | D232 | C 3181-2 | 1N4148 |
| D133 | D233 | C 3181-2 | 1N4148 |
| D134 | D234 | C 3181-2 | 1N4148 |

Transistors

| | | | |
|------|------|----------|-------------|
| Q100 | Q200 | D 2961-7 | NPN 2N3859A |
| Q101 | Q201 | C 3578-9 | PNP MPSA93 |
| Q102 | Q202 | C 3810-6 | NPN MPSA43 |
| Q103 | Q203 | C 3786-8 | PNP PN4250 |
| Q105 | Q205 | C 3578-9 | PNP MPSA93 |
| Q106 | Q206 | C 3625-8 | NPN 2N4125 |
| Q107 | Q207 | C 3786-8 | PNP PN4250 |
| Q108 | Q208 | C 5891-4 | NPN MTS105 |
| Q109 | Q209 | D 2961-7 | NPN 2N3859A |
| Q110 | Q210 | C 3810-6 | NPN MPSA43 |
| Q112 | Q212 | C 3625-8 | NPN 2N4125 |

Q43237-9 Main Module (D 8369-7 board) Parts List

| | | | |
|------|-------|--------------|--------------------|
| R180 | R280 | A10266-4711 | 470 |
| R181 | R281 | A10266-4721 | 4.7K |
| R182 | R282 | A10266-2201 | 22 |
| R183 | R283 | A10266-2421 | 2.4K |
| R184 | R284 | A10266-4741 | 470K |
| R185 | R285 | A10266-2421 | 2.4K |
| R186 | R286 | A10266-2751 | 2.7M |
| R187 | R287 | A10266-3631 | 36K |
| R188 | R288 | A10266-3631 | 36K |
| R189 | R289 | A10266-2731 | 27K |
| R190 | R290 | A10266-2051 | 2M |
| R191 | R291 | A10266-1831 | 18K |
| R192 | R292 | A10266-6821 | 6.8K |
| R193 | R293 | A10266-6821 | 6.8K |
| R194 | R294 | A10266-1041 | 100K |
| R195 | R295 | A10266-3021 | 3K |
| R196 | R296 | A10266-4721 | 4.7K |
| R197 | R297 | A10266-1031 | 10K |
| R198 | R298 | A10266-4721 | 4.7K |
| R199 | R299 | A10266-1031 | 10K |
| R300 | R400 | A10266-1041 | 100K |
| R301 | R401 | A10266-1041 | 100K |
| R906 | R1006 | OPEN | |
| R907 | R1007 | OPEN | |
| R908 | R1008 | OPEN | |
| R909 | R1009 | A10266-4741 | 470K |
| R910 | R1010 | A10266-4741 | 470K |
| R911 | R1011 | A10266-1521 | 1.5K |
| R912 | R1012 | A10266-4711 | 470 |
| R913 | R1013 | A10266-1051 | 1M |
| R914 | R1014 | A10266-1051 | 1M |
| R915 | R1015 | A10266-2201 | 22 |
| R916 | R1016 | A10266-2201 | 22 |
| R917 | R1017 | A10265-10021 | 10K 1% |
| R918 | R1018 | A10265-10021 | 10K 1% |
| R919 | R1019 | A10265-10021 | 10K 1% |
| R920 | R1020 | A10265-10021 | 10K 1% |
| R921 | R1021 | C 9079-2 | 200 Pot (CMR Null) |
| R922 | R1022 | A10265-66501 | 665 1% |
| R923 | R1023 | A10265-35711 | 3.57K 1% |
| R924 | R1024 | A10265-66501 | 665 1% |
| R925 | R1025 | A10265-10031 | 100K 1% |
| R926 | R1026 | A10265-66501 | 665 1% |
| R927 | R1027 | A10265-10031 | 100K 1% |
| R928 | R1028 | A10265-35711 | 3.57K 1% |
| R929 | R1029 | A10266-1041 | 100K |
| R930 | R1030 | A10266-1041 | 100K |

Resistor Networks

| | | | |
|------|------|----------|------------------|
| N101 | N201 | D 7945-5 | Resistor Network |
| N102 | N202 | D 6082-8 | Resistor Network |

Switches

| | | | |
|----|--|----------|---------------------|
| S3 | | C 7960-5 | Sensitivity |
| S4 | | C 6781-6 | Switch, Stereo/Mono |

Integrated Circuits

| | | | |
|------|------|----------|----------|
| U1 | | C 5095-2 | UA7815 |
| U2 | | C 5096-0 | UA7915 |
| U100 | U200 | C 6911-9 | UPA75 |
| U101 | U201 | C 4345-2 | LM339 |
| U102 | U202 | C 4345-2 | LM339 |
| U103 | U203 | C 6910-1 | UPA76 |
| U104 | U204 | C 7558-7 | MC33079P |

Misc.

| | | | |
|-------------|------|-------------|----------------------|
| Board | | D 8369-7 | |
| Socket | | C 3450-1 | 14 Pin (Qty 6) |
| Nut | | A10102-5 | Hex 6-32 (Qty 2) |
| Heatsink | | C 5341-0 | TO-220 (Qty 2) |
| Tq Spreader | | C 6541-4 | (Qty 2) |
| Washer | | A10096-5 | #6, Split (Qty 2) |
| Screw | | A10240-0608 | Stainless (Qty 2) |
| J1 | | C 7593-4 | 5 Pin Header |
| J2 | | C 4508-5 | 16 Pin Socket |
| J11 | | C 7526-4 | 3 Pin Header |
| J100 | J200 | OPEN | |
| J500 | J800 | D 6619-7 | 10 Inch Ribbon |
| J600 | J700 | D 6620-5 | 6 Inch Ribbon |
| Cable Tie | | C 1811-6 | (Qty 4) |
| TP 1 | | C 9450-5 | Header, 6 pin RT Ang |
| Spacer | | C 9225-1 | Plastic Spcr (Qty 5) |