



AMCRON®

GEODYNE™ II
POWER AMPLIFIER
SERVICE MANUAL

©1992 by CROWN INTERNATIONAL, INC.

Mailing Address:
P.O. Box 1000
Elkhart, IN 46515-1000

Shipping Address:
57620 C.R. 105
Elkhart, IN 46517-4095

Amcron®, *Crown®*, *IOC®*, *Multi-Mode®*, *ODEP®* and are registered trademarks of Crown International, Inc. *Geodyne™*, *Grounded Bridge™* are trademarks of Crown International, Inc.

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 your Amcron Representative or the Amcron Technical Service Department.

Amcron, P.O. Box 1000, Elkhart, Indiana U.S.A. 46515-1000

Phone: (219) 294-8000

(219) 294-8200

Amcron FAX: (219) 294-8329

Technical Service FAX: (219) 294-8301

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'OUVRIR LA MODULE EN ARRIÈRE.



WARNING

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

Table of Contents

PART I - Technical Information	PART II - Component Documentation
1 Introduction 1-2	<i>Parts</i>
1.1 The Geodyne II 1-2	<i>General Information</i>
1.2 Warranty 1-2	<i>Standard and Special Parts</i>
2 Maintenance 2-1	<i>Ordering Parts</i>
2.1 Identifying Symptoms 2-1	<i>Shipment</i>
2.2 Checkout/Adjustment Procedures 2-1	<i>Terms</i>
3 Voltage Conversion 3-1	7 Exploded View Drawings 7-1
4 Circuit Theory 4-1	8 Circuit Board Artwork 8-1
4.1 Stereo Operation 4-1	
4.1.1 Input Stage 4-1	
4.1.2 Voltage Amplifier Stage 4-1	
4.1.3 Output Stage 4-2	
4.1.4 Bias 4-2	
4.1.5 O.D.E.P. 4-3	
4.2 Bridge Mono Operation 4-3	
4.3 Parallel Mono Operation 4-3	
4.4 Power Supply 4-3	
4.5 Input/Output Comparator (IOC®) 4-3	
4.6 Turn-on Delay 4-3	
4.7 DC/LF Protection 4-3	
4.8 Common Mode Fault Protection 4-3	
5 Specifications 5-1	
5.1 Performance 5-1	
5.2 Power 5-1	
5.3 Controls 5-1	
5.4 Indicators 5-1	
5.5 Input/Output 5-1	
5.6 Connectors 5-1	
5.7 Construction 5-1	
6 Schematics 6-1	

List of Illustrations

Fig. 1.1 Geodyne II	1-2
Fig. 2.1 Bridged MONO	2-2
Fig. 2.2 Differentiated RC Circuit	2-3
Fig. 2.3 Differentiated Square Wave	2-3
Fig. 2.4 10kHz Square Wave	2-4
Fig. 2.5 Inductive Load	2-4
Fig. 2.6 ODEP Protection	2-5
Fig. 3.1 Power Transformer Wiring Diagram	
3-2	
Fig. 4.1 Grounded Bridge Topology	4-2
Fig. 4.2 Geodyne II Block Diagram	4-3
Fig. 7.1 Chassis Assembly (Top)	7-2
Fig. 7.2 Chassis Assembly (Bottom)	7-4
Fig. 7.3 Heatsink Assembly	7-6
Fig. 7.4 Transmotor Assembly	7-7
Fig. 7.5 Capacitor Assembly	7-8
Fig. 7.6 Display Bezel Assembly	7-9
Fig. 7.7 LED/Volume Board Assembly	7-10
Fig. 7.8 Wiring Diagram (Top)	7-11
Fig. 7.9 Wiring Diagram (Bottom)	7-12
Fig. 7.10 Thermal IC Mounting	7-13
Fig. 8.1 Control Module (Q42849-2)	8-2
Fig. 8.2 Output Module (Q42856-7)	8-5
Fig. 8.3 Main Module (Q42857-5)	8-10

PART I

Technical Information



Fig. 1.1 Geodyne II

1 Introduction

This manual contains service information on the Amcron Geodyne II power amplifier. It is designed to be used in conjunction with the Geodyne II 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!

1.1 The Geodyne II

The Geodyne II amplifier is a compact, audio power amplifier designed for professional use. Providing high power amplification from 20Hz-20KHz with minimum distortion, the unit features balanced 1/4" phone inputs, bridged and parallel monophonic capability.

1.2 Warranty

Each Owner's Manual contains basic policies as related to the customer. For further assistance, please contact the Technical Service Department or Director of Customer Service at:

AMCRON®
 Division of
 Crown International, Inc.
Shipping Address:
 57620 C.R. 105
 Elkhart, Indiana 46517-4095
Mailing Address:
 P.O. Box 1000
 Elkhart, Indiana 46515-1000
 Phone: (219) 294-8000
 FAX: (219) 294-8301
 BBS: (219) 294-8284

2 Maintenance

The three steps to effective troubleshooting and repair can be summarized in the three following questions: What is the problem (effect)? What is causing the problem (cause)? What can be done to eliminate the cause (repair)? The purpose of this section is to help you answer these questions in an orderly manner.

Finding and fixing the problem(s) is not the end of maintenance. The final step is to thoroughly test the amplifier to be certain that it meets the factory specifications after it has been repaired. The test procedures in section 2.2 will help you do this as well as aid you in locating the cause of problem(s).

2.1 Identifying Symptoms

Why was the amplifier brought in for repair? Can you get it to malfunction again? (Some problems can be intermittent and difficult to find.) If you don't observe anything wrong

with the amplifier, tactfully inquire how the owner used it and try to determine if it was misused or some other component in their system could have been at fault.

2.2 Geodyne II Electrical Checkout and Adjustment Procedures

The following instructions outline an orderly checkout and troubleshooting procedure. The purpose and arrangement of this procedure is to determine the cause of the trouble as quickly as possible, leading to a detection of which component part(s) must be replaced or repaired.

WARNING!!

Most adjustments are made with protective covers removed. This means prior to any non-ac-powered testing, discharge all power capacitors. Also, use extreme caution while making any internal adjustments when the unit is powered.

Type of Test or Adjustment	Input Signal Characteristics	Comments
1. Bias	None	<p>Measure the voltage across R302 and R402. The bias voltage should equal .350 VDC + .025 V - .000 V. If the bias voltage needs to be adjusted, adjust R326 and R426 for the correct bias voltages. Next measure the voltage across R321 and R421. This voltage should equal .350 VDC \pm .025 V. If the bias voltage needs to be adjusted, adjust R323 and R423 for the correct bias voltage. Quiescent power of less than 90 watts.</p> <p>Check the voltage across R309, R409, R322 and R422 to make sure it is between .500 to .600 VDC.</p>
2. DC Output Offset	None	<p>With the input level controls (R500 and R600) turned fully clockwise, the DC offset for both channels should be \pm 10 millivolts. Note: There is no output offset adjustments for the Geodyne II.</p>
3. O.D.E.P Null	None	<p>With the amplifier cool, pin 1 of S100/S200 should measure -10VDC (\pm1V). If needed, adjust R121 and R221 for the</p>

Type of Test or Adjustment	Input Signal Characteristics	Comments
4. Input C.M.R.	1kHz sine wave; .775V	<p>correct voltages. Pin 3 of S100/S200 should measure +11.1VDC +/- .1V. If needed, adjust R132 and R232 for the correct voltages.</p> <p>Using a balanced 1/4 inch input jack with the tip and ring shorted together, insert a .775 VAC 1 kHz sine wave signal into the amplifier input. For amplifiers in 1.4 or 26dB sensitivity use a 1.4VAC or 2.4 VAC signal. While monitoring the outputs of channel one with an oscilloscope adjust N100 for an output null (13mV or less). Using N200, repeat setup and test in channel 2.</p>
5. Monophonic Performance	1kHz sine wave; .775V	<p>-Parallel Mono Tests With the dual/mono switch in the parallel mono position, insert a .775 VAC 1 kHz signal into channel one. There should be two in-phase signals present, equal in amplitude, at the outputs of channels one and two (CH 2 IOC will illuminate in this mode). Both of these signals will be controlled by channel one input level control. Switch the stereo/mono switch to stereo. There should be signal present only on channel one output.</p> <p>-Bridge Mono Tests With the dual/mono switch in the bridge mono position, set the channel two input level control to full CCW. Insert a .775 VAC 1 kHz signal into channel one input. There should be signal present on both channel outputs, equal in amplitude, with channel two 180 degrees out of polarity from channel one (see Fig. 2.1). Channel one input level control should control the output level for both channels. Return the amplifier to stereo operation.</p>

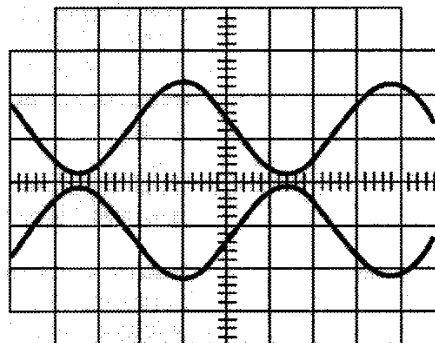


Fig. 2.1 Bridge MONO

Type of Test or Adjustment	Input Signal Characteristics	Comments
6. Current Limit Tests	1kHz sq. wave; 1 ohm	<p>THE FOLLOWING CHECKS ARE DONE BY USING A LOAD. PLEASE USE CAUTION AND FOLLOW THE CHECK OUT PROCEDURES CAREFULLY TO ENSURE CORRECT RESULTS.</p> <p>NOTE: The following tests are done assuming that the amplifier is configured for .775 V input sensitivity. Input voltages will need to be greater if the amplifier has a 1.4 or 26dB input sensitivity.</p> <p>CAUTION: THE FOLLOWING TESTS WILL REQUIRE A RESISTIVE LOAD CAPABLE OF 600 WATTS INTO TWO OHMS.</p> <p>NOTE: The current limit tests require a differentiated square wave input. See Fig. 2.2 for a circuit to create a differentiated square wave.</p> <p>On the channel under test insert a 1 kHz differentiated square wave. With a one ohm load on the output, monitor the output waveform with an oscilloscope. Slowly increase the input signal until the output signal starts to clip as shown in Fig. 2.3. Current limiting should take place when the output reaches a 15 volt peak ($\pm 2\%$), which would produce 15 amps ($\pm 2\%$) of output current.</p>

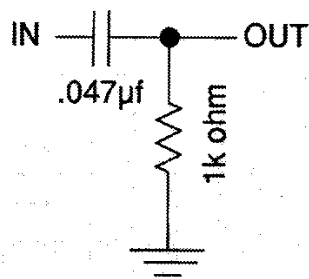


Fig. 2.2 Differentiated RC Circuit

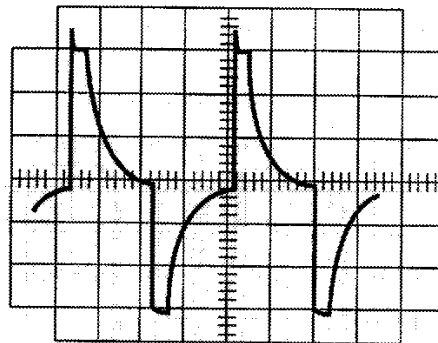


Fig. 2.3 Differentiated Square Wave

Type of Test or Adjustment	Input Signal Characteristics	Comments
7. 10 kHz Square Wave	10kHz sq. wave; 8 ohm	With an 8 ohm load on each channel insert a 10 kHz square wave to produce a 20 volt peak output (Fig. 2.4). Observe the rise time of the signal which should be 13 volts per microsecond. The output waveform should be stable with no ringing. Some overshoot may occur with peak output voltages greater than 20 volts.
8. 20 kHz Sine Wave	20kHz sine wave; 8 ohm	With an 8 ohm load on each channel insert a 20 kHz sine wave on both inputs. Vary the amplitude of the input signal and observe where clipping takes place. The amplifier should produce at least 46.9 VAC on the output before clipping occurs. THD should be less than .1%.
9. 1 kHz Power Checks	1kHz sine wave; 8 ohm	With both channels operating, insert a 1 kHz signal into the inputs. Observe the following output voltages with the various output loads. 8 Ohm Load Minimum output voltage before clipping should be 50.6 VAC (320 watts).
	1kHz sine wave; 4 ohm	4 Ohm Load Minimum output voltage before clipping should be 40.0VAC (400 watts).
10 Inductive Load	1kHz sine wave; .775V; 159µh coil	Insert a 1 kHz sine wave, .775 VAC into both channels and connect a 159 microhenry inductive load (paralleled with an 8 ohm resistor) on the output of each channel. Observe the output waveform. It should be similar to that in Fig. 2.5.

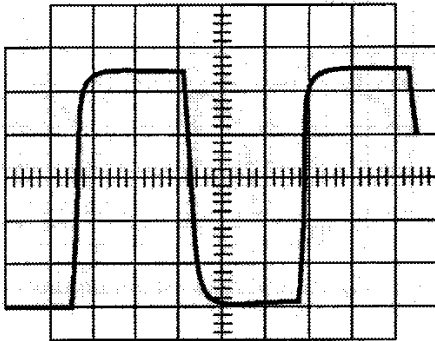


Fig. 2.4 10kHz Square Wave

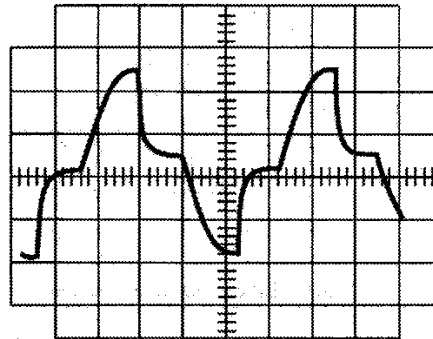


Fig. 2.5 Inductive Load

Type of Test or Adjustment	Input Signal Characteristics	Comments
11. ODEP Limiting	60Hz sine wave; output of 12VAC	For the following tests, the cooling fan blade must be stopped to allow the heatsinks to heat up. With a 2 ohm load per channel and output voltage of 14.6 VAC 60 Hz to both channels. Allow the heatsinks to heat up until the ODEP protection circuit starts to limit the output signal. The waveform in Fig. 2.6 should be observed. On the Geodyne III check to see that the IOC LED is lit when ODEP is activated. Next configure the amp for parallel mono operation. With the input signal now present on channel one only, load channel one output with 8 ohms and channel two with 2 ohms. Observe that channel two ODEP protection circuit is limiting both channel one and channel two outputs. Next load channel one with 2 ohms and channel two with 8 ohms. Observe that channel one ODEP protection circuit is limiting both channel one and channel two outputs. Reinstall the cooling fan blade after this test has been completed.
12. I.M. Distortion	60Hz/7kHz (4:1 ratio); 8 ohm	Using a 60Hz/7 kHz input signal summed in a 4:1 ratio with 8 ohm loads on both channels measure the I.M. distortion at the rated output of 320 watts for each channel. Readings should be less than .1% from 22 milliwatts to 320 watts.
13. T.H.D. Measurements	20kHz sine wave; 8 ohm; (37.42V)	Using a 20 kHz input signal with 8 ohm loads on both channels measure the T.H.D. distortion at the rated output of 275 watts for each channel. The rated RMS sum total harmonic distortion should be less than .1% of the fundamental output voltage.

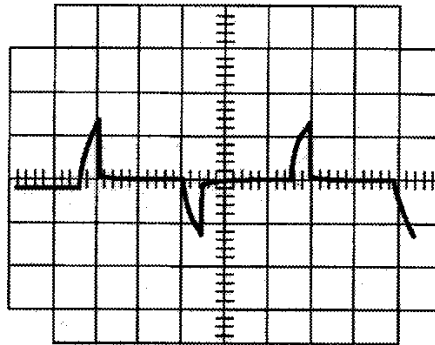


Fig. 2.6 ODEP Protection

Type of Test or Adjustment	Input Signal Characteristics	Comments
14. Signal To Noise	None: 26dB gain position	With input jacks shorted insure that each channel has a signal-to-noise ratio greater than -100 dB below the rated power of 320 watts into 8 ohms. Be sure to use a 20 Hz to 20 kHz bandpass filter ahead of the voltmeter (or -105dB A weighted).
15. LED Operation	1kHz sine wave; no load: 2VAC	With no load on the amplifier apply a 2 VRMS, 1 kHz signal to the input of each channel. Note that the yellow LED is lit to indicate an IOC event. Now turn the level down and note that the yellow LED extinguishes when the amplifier comes out of output stage overload. Check both channels.

3 Voltage Conversion

The Amcron Geodyne II can be wired for 100VAC, 120VAC, 220VAC, 230VAC or 240VAC operation. This is made possible by use of a multitap transformer for the high energy power supplies. However the transmotor, which acts as the low voltage power supply transformer, is a single tap device. There are three transmotors available, one for 100VAC, one for 120VAC operation, and one for 220VAC/230VAC /240VAC operation. If an Amcron customer wishes to convert from 240VAC to 120VAC the high energy transformer can be rewired but the 240VAC transmotor would have to be replaced with the 120VAC transmotor (transmotor fuse usage; 1/2 amp for 120V and 1/4 amp for 240V). Converting from one to another can be accomplished with a soldering iron and a pair of wire cutters. Follow the table shown with the schematic, and the drawing in figure 3.1 (page 3-2).

CAUTION: Because there is a risk of electric shock, only a competent technician should attempt to alter the line voltage configuration.

1. Unplug unit and remove the top cover of the Geodyne II (held on by 8 screws).
2. With the front panel toward you, locate the terminal strip fastened to the power transformer. Discharge C126 and C226 in the power supply.
3. Make the appropriate change in jumpers for the desired operating voltage. See Fig. 3.1
4. Replace the 16 amp power switch/circuit breaker with the 8 amp power switch/circuit breaker, for all connections 220V and above.
5. Install appropriate fuse for transmotor.
6. Replace cover and cover hardware.
7. Change the line cord tag to read the correct voltage.

Note: Use only the 16 amp power switch/circuit breaker for 100VAC or 120VAC operation. Use only the 8 amp power switch/circuit breaker for 220VAC, 230VAC or 240VAC operation.

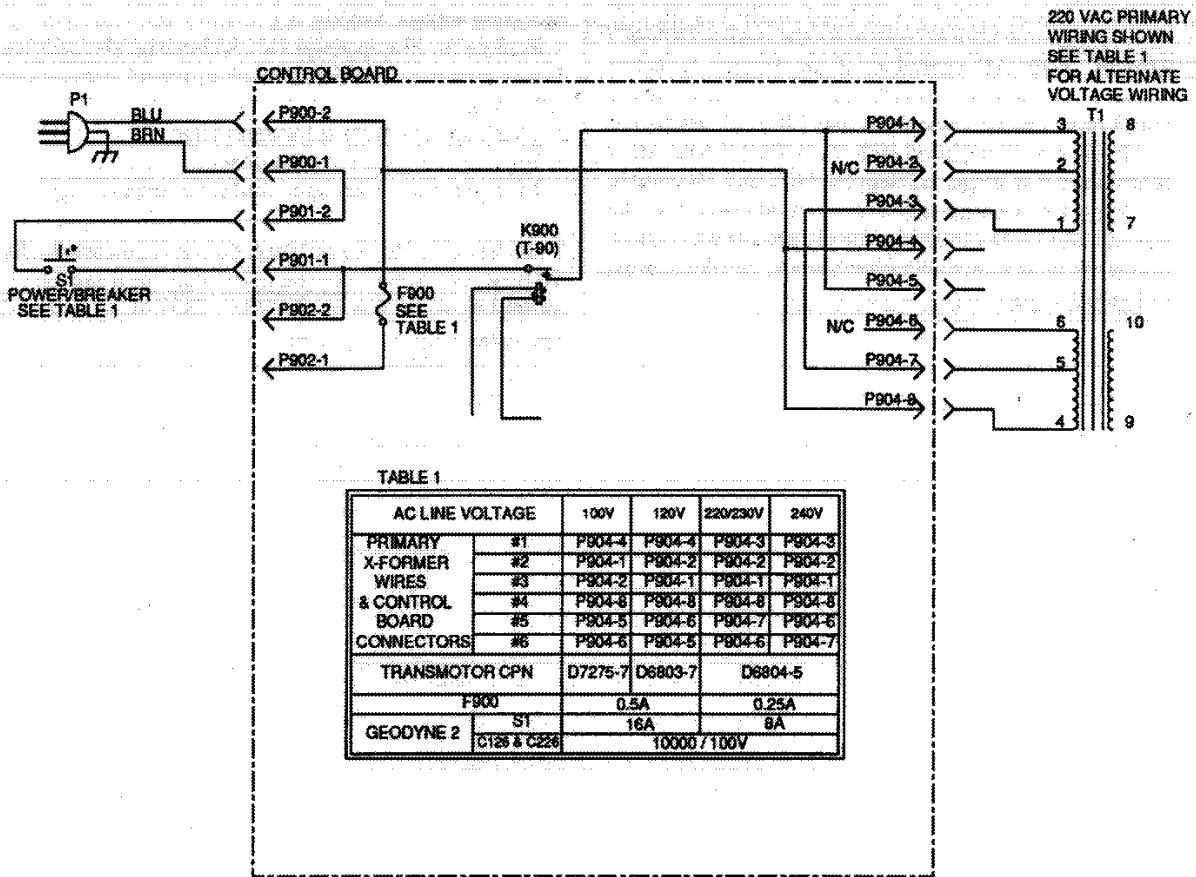


Fig. 3.1 Power Transformer Wiring Diagram

4 Circuit Theory

The Geodyne II amplifier incorporates several new technological advancements including real-time computer simulation, a low-stress output stage, and an advanced heat-sink embodiment. The Geodyne II has extra circuitry to limit current and temperature to safe levels, making it highly reliable and tolerant of faults. Unlike many lesser amplifiers, it can operate at its voltage and current limits without self-destructing.

Real-time computer simulation (ODEP*) is used to create a model of the output devices' junction temperature, which is unmeasurable directly. Current is limited only when the device temperature becomes excessive—and just by the minimum amount necessary. This patented approach maximizes the available output power and eliminates overheating—the major cause of device failure.

The topology used in the Geodyne II amplifier output stage is called "the Grounded Bridge," and makes full use of the power supply. This patented topology also provides peak-to-peak voltages available to the load that are twice the voltage the output devices are exposed to.

The Grounded Bridge topology is ground-referenced. Composite devices are constructed to function as gigantic NPN and PNP devices, since the available currents exceed the limits of existing devices. Each output stage has two of these composite NPN devices and two composite PNP devices.

The devices connected to the load are referred to as "high-side NPN and PNP" and the devices connected to ground are referred to as "low-side NPN and PNP." Positive current is delivered to the load by increasing conductance simultaneously in the high-side NPN and low-side PNP stage, while decreasing conductance of the high-side PNP and low-side NPN in synchrony.

The two channels may be used together to double the voltage or the current presented to the load. This feature gives the user flexibility in maximizing the power available to the load.

The Geodyne II amplifier utilizes a wide-bandwidth multiloop design that uses state-of-the-art compensation techniques. This produces ideal behavior and results in ultra-low distortion values.

Aluminum extrusions have been widely used for heat sinks in power amplifiers due to their low cost and reasonable performance. However, measured on a watts/kilogram, basis or a watts/volume basis, extrusion technology doesn't perform nearly as well as the heat-sink technology developed for the Geodyne II power amplifier.

The Geodyne II power devices are mounted directly to massive heat spreaders that are electrically hot. Making the heat spreaders electrically hot allows improved thermal performance by eliminating the insulating interface underneath the power devices. The chassis itself is used as part of the thermal circuit, and this maximizes utilization of the available resources.

4.1 STEREO OPERATION

For simplicity, the discussion of stereo operation will refer to one channel only. Mono operations will be discussed later.

Please refer to section 6 for the schematics diagrams and page 4-4 for the Geodyne II block Diagram.

4.1.1 Input Stage

The input signal enters at the 1/4" phone jack and passes directly into the balanced gain stage (U104-A).

The signal then passes to the gain stage (U104-B) where the .775VAC input signal obtains sufficient gain to drive the main loop to rated output. From there, input level can be controlled with potentiometer R500. The error amp (U104-C) amplifies the difference between the output signal and the input signal from the input level control, and drives the signal translator stage (Q101-Q102). From the signal translator stage the signal is sent to the voltage-translator stage.

4.1.2 Voltage Amplifier Stage

The voltage-translator stage channels the signal to the Last Voltage Amplifiers (LVA) depending on the signal polarity from the error amp U104-C. The +LVA (Q105) and the -LVA (Q110), with their push-pull effect through the bias servo Q318, drive the fully complementary output stage.

The bias servo Q318 is thermally coupled to the heat sink, and sets the quiescent bias current in the output stage to lower the distortion in the crossover region of the output signal. D301, D302, D303, and D304 are used to remove the charge on the unused portion of the output stage, depending on the polarity of the output signal.

With the added voltage swing provided by the LVAs, the signal then gains current amplification through the Darlington emitter-follower output stage.

4.1.3 Output Stage

Fig. 4.2 is an example of Amcron's grounded bridge output topology; there are two darlington (composite) emitter follower stages per channel. The high side of bridge and the

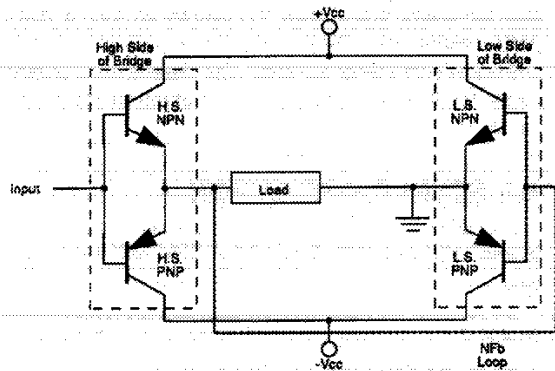


Fig. 4.1 Patented Grounded Bridge Topology

low side are each made up of a three deep darlington NPN and PNP section.

The high side of the bridge operates as a normal bipolar output stage configuration. As input drive becomes more positive the high side NPN stage conducts and becomes a low impedance path for current flow. Eventually full +VCC is across the load. Depending on the signal polarity the load swings between plus and minus VCC.

The low side of the bridge operates quite differently. As the high side NPN stage is turned on the low side PNP stage is turned on as well. Since the low side bridge is grounded and the high energy power supply transformer secondary is not, the power supplies will swing. This swing causes the power supply reference to change.

As a result, the high side NPN stage turns on, swinging the load to +45VCC, the low side PNP shifts the power supply reference point by +45 VCC. Thus, a 90V nominal appears across the load.

Signal flow proceeds from the positive voltage amplifier (Q105) to the high side NPN darlington stage, and from the negative voltage amplifier (Q110) to the high side PNP darlington stage. The low side of the bridge receives it's

drive from the Negative Feedback loop. From the NFB loop the signal is then fed to U104-D through N102. (The low side of the bridge has composite voltage and current gain). When the high side NPN stage is on, the positive going signal is inverted by U104D and turns on the low side PNP. When the high side PNP stage is on, the negative going signal is inverted by U104D and turns on the low side NPN.

Flyback diodes (Q305 and D306 for H.S. - D307 and D308 for L.S.) are used to protect output devices from overvoltage. When the transducer back EMF is .6V greater than the power supply voltage the flyback diodes shunt the current into the power supply.

4.1.4 Bias

Q318 serves as the bias servo for the high side of bridge. When biased correctly the collector to emitter voltage will be 3.3V. This 3.3V is in parallel with the H.S. output stage. Each predriver and driver has a base to emitter drop of .6V. The positive output devices will have .35V and the negative output devices will have .55V base to emitter drop. All adding up to 3.3V. The H.S. bias should be adjusted by R326 for .35V across R302.

D309 through D312 serve as a diode string that provides bias for the low side of bridge drivers and output devices. When biased correctly the voltage drop across the four diodes will be 2.1V. This 2.1V is in parallel with the L.S. driver and output devices. Each driver has a base to emitter drop of .6V. The positive output devices will have .35V and the negative output devices will have .55V, All adding up to 2.1V. The L.S. bias should be adjusted by R323 for .35V across R321.

Q107 and Q108 serve as a current limiting short circuit protection mechanism. A voltage related to the output stage current, sensed through R304 and R307, is fed to the base of Q107 and Q108. When excessive current is approached Q107 and/or Q108 will turn on shunting base current away from the predriver bases.

Common Mode Current is a phenomenon that takes place at high frequency operation. Because of the size and structure of bipolar drivers and output devices, internal capacitance exists. As frequency operation increases this capacitance begins to charge. This charge eventually leads to the output stage drawing high current. D301-D304 in the H.S. of bridge and D309-D312 in the L.S. of bridge serve to lower this charge. (D309-D312 are also the L.S. of bridge bias network.

4.1.5 O.D.E.P.

To further protect the output stages, a specially developed "ODEP" (Output Device Emulator Protection) circuit is used. It produces a complex analog output signal proportional to the always changing safe-operating-area margin of the output transistor. This output signal controls the translator stage previously mentioned, removing any further drive that may exceed the safe-operating-area of the output stage.

Thermal sensor S100 gives the ODEP circuits vital information on the operating temperature of the heat sink on which the output devices are mounted. This signal, when mathematically combined with the complex ODEP signal form the heart of the patented ODEP protection scheme.

4.2 BRIDGE MONO OPERATION

By setting the rear-panel slide switch to BRIDGE MONO, the user can convert the Geodyne II into a bridge-mono amplifier. With a signal applied to the Ch. 1 input jack, and the load between the red binding posts on the back panel, a double-voltage output occurs.

The Ch. 1 output feeds the Ch. 2 error amp U204-C. Since there is a net inversion, Ch. 2 output is out-of-phase with Ch. 1. This produces twice as much voltage across the load. Each of the channels' protection mechanisms work independently if a fault occurs.

4.3 PARALLEL MONO OPERATION

With the rear-panel slide switch set to PARALLEL MONO, the output stage of Ch. 2 is paralleled with that of Ch. 1. A suitable high-current-handling jumper must be connected across the red binding posts to gain the benefits of this mode of operation.

The signal path for Ch. 1 is the same as previously discussed, except that Ch. 1 also drives the output stage of Ch. 2. The balanced gain stage, error amp, translators, and LVAs of Ch. 2 are disconnected and no longer control the Ch.-2 output stage. The Ch.-2 output stage and protection mechanisms are also coupled through S4 and function as one.

4.4 Power Supply

A thermal switch embedded in each transformer protects it from overheating.

The low-voltage transmotor uses a separate winding on the fan motor. The motor output, rectified by diodes D1, D2, D4 and D5 generates an unregulated 24 volts. Monolithic regulators U1 and U2 provide a regulated ± 15 volts.

4.5 INPUT/OUTPUT COMPARATOR (IOC[®])

The error amp signal, generated by the main opamp in the front end of the main amplifier loop (U104/U204), is sent to U900. Used as a window comparator U900 has a threshold of $\pm 5V$. The \pm threshold level will cause the window comparator to go high (a positive voltage), biasing off Q901/Q902 which in-turn keeps LEDs E500/E501 off. The error signal from U104/U204 will, of course, exceed this level ($\pm 7V_{pk}$), causing Q901/Q902 to turn on which then turns on E500/E501.

4.6 TURN-ON DELAY

U102 pin 10 is a high impedance input. Upon turn-on, C110, through R190, begins to charge. When the voltage level exceeds ground potential, pin 13 of U102D switches states (-15V). This switch of states causes the turn-on of the secondary power supplies and enables the voltage translator stages through Q121.

4.7 DC/LF PROTECTION

J500 10, being connected to the Negative Feedback loop of channel one, passes the amplifier output signal through a low pass filter (R184, C119, R186 and C107) to the window comparator U102 A and U102 B. If the output signal is above $\pm 3V_{dc}$ and is below $\approx 5Hz$ than the output of the window comparator (pins 1 and 2) go low (-15V). This results in U102 pin 13 going to a high state which shuts down the signal translator stage and disables the secondary high energy power supply.

4.8 COMMON MODE FAULT PROTECTION

The *FAULT* circuitry is designed to disable the secondary high energy power supply in the event of an output stage fault. A *FAULT* is defined as anytime the output semiconductors in both the negative and positive sections draw currents in excess of 5 amperes (ex: Q303 and Q307).

The low side of bridge Fault detector consists of U101 A and U101 B. If both output devices (NPN and PNP) are conducting currents in excess of 5 amperes or more the output of U101 A and U101 B go high which disables the amplifier channel affected.

The high side of bridge Fault detection consists of U101 C and U101 D. Since the high side of bridge has a large voltage swing the Fault circuit is formed using a balanced input to cancel the high output voltage level and leave a voltage level representative of the emitter current conducting through the high side NPN and PNP stages. R154, R160, R163, R164, R165 and R173 reduce the levels to within the comparator ranges (U101) while R145 and R166 supply the reference for the 5 ampere sense.

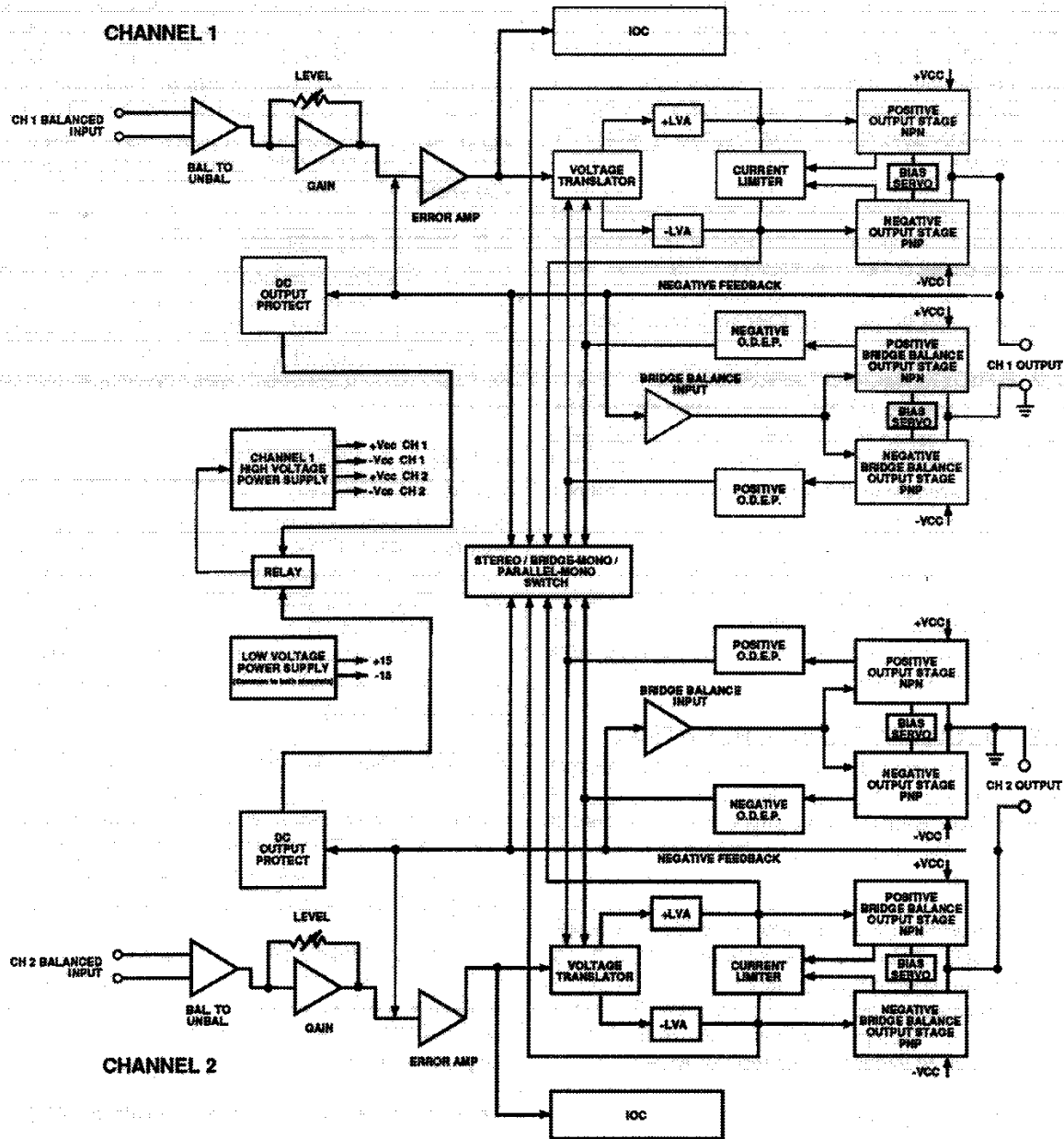


Fig. 4.2 Geodyne II Block Diagram

5 Specifications

Amcron specifications are guaranteed for three years. Further, because our in-house specs are more stringent than our published specs, every Amcron amplifier will *exceed* its published specs.

5.1 PERFORMANCE

Note: Measurements made in Stereo, both channels driven into 8 ohms.

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:

At 26 dB gain, better than 100 dB below (20 Hz to 20 kHz) 320 W.

Total Harmonic Distortion (THD):

$<0.05\%$ from 20 Hz to 1 kHz, increasing linearly to 0.1% at 20 kHz at 310 W continuous average power into 8 ohms.

I.M. Distortion:

$<0.05\%$ from 10 milliwatts to 200 W at 26 dB gain.

Slew Rate: >13 V per microsecond.

5.2 POWER

Output Power: (Max. average power at 1 kHz with 0.1% THD.)

Stereo—400 W/channel into 4 ohms, 320 W/channel into 8 ohms, both channels driven.

Bridged Mono—965 W into 8 ohms, 680 W into 16 ohms.

Parallel Mono—955 W into 2 ohms, 680 W into 4 ohms.

Load Impedance: Rated for 16, 8, 4, 2 ohm use. Safe with all types of loads, even reactive ones.

Required AC Mains: 50/60 Hz, 100, 120, 220/230, 240 VAC with typical 15 amp branch circuit.

AC Line: Three wire cord with country specific connector.

5.3 CONTROLS

Controls:

Front panel—A push on/off power switch/circuit breaker; also, a signal level control for each channel.

Back panel—A three-position switch which selects Stereo, Bridged-Mono, or Parallel-Mono mode. Inside the amplifier, a three-position switch selects 1.4 V, 0.775 V, or 26 dB voltage gain input sensitivity.

5.4 INDICATORS

Red Enable indicator shows on/off status of low-voltage power supply.

Yellow IOC indicator for each channel lights if distortion of any kind exceeds 0.05%

5.5 INPUT/OUTPUT

Input Impedance: Nominally 20 K ohms, balanced, and 10 K ohms, unbalanced.

5.6 CONNECTORS

Inputs — balanced 6.3 mm phone jacks.

Outputs — colour-coded 5-way binding posts on 19 mm centers; spaced 19 mm apart.

5.7 CONSTRUCTION

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

Dimensions: 48.3 cm (19 in.) wide, 8.9 cm (3.5 in.) high, 40.6 cm (16 in.) deep behind front mounting surface.

Weight: 14.5 kg (32 lbs)

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

6 Geodyne II Schematic Diagrams

J 0435-8 Geodyne II Main Circuit Schematic (Parts 1 and 2)

PART II

COMPONENT DOCUMENTATION

Parts

General Information

This section contains illustrations and parts lists for the Geodyne II power amplifier. This information should be used with the service, repair and adjustment procedure in Section 2.

Standard and Special Parts

Many electrical and electronic parts used in the Geodyne II are standard items stocked by and available from electronic supply houses. However, some electronic parts that appear to be standard, are actually special. A part ordered from Amcron will assure an acceptable replacement. Structural items, covers and panels are available from Amcron only.

Ordering Parts

When ordering parts, be sure to give the amplifier model and serial number and include the part description and Crown Part Number (CPN) from the parts list. Price quotes are available upon request.

Shipment

1. Amcron will determine the best method of shipment unless a preferred method is specified.
2. Shipments are made F.O.B. Elkhart, Indiana - freight collect.
3. Where credit terms allow, freight may be prepaid by Amcron and added to your invoice.

Terms

1. The order must be prepaid.
 2. Net 30 days terms apply only to those customers who have an established line of credit with Amcron.
 3. If prepaying please add an amount for the freight charge.
- NOTE: Part prices are subject to change without notice.

Illustrated Parts Lists

Contained within this section are the illustrated parts lists for the Geodyne II amplifier. Most of the mechanical and structural parts are illustrated and indexed in the main chassis illustration. The electrical and electronic parts in the assembly drawings are also shown in the circuit schematics (Section 6) and are labeled in the parts list with both the schematic component number and the Crown Part Number (CPN).

Electric and electronic parts which are located on printed circuit boards are illustrated by schematic symbols on the trace side of the boards and by their component shape symbol on the component side of the boards. Schematic component numbers also appear on these drawings.

The quantity of each part used in each location is also shown in the parts list.

7 EXPLODED VIEW DRAWINGS

The *Exploded Views* section of this service manual is the compilation of drawings and parts lists of the chassis and components parts found within the Geodyne II amplifier. For schematic drawings see section 6 and for circuit board layouts and parts lists see section 8.

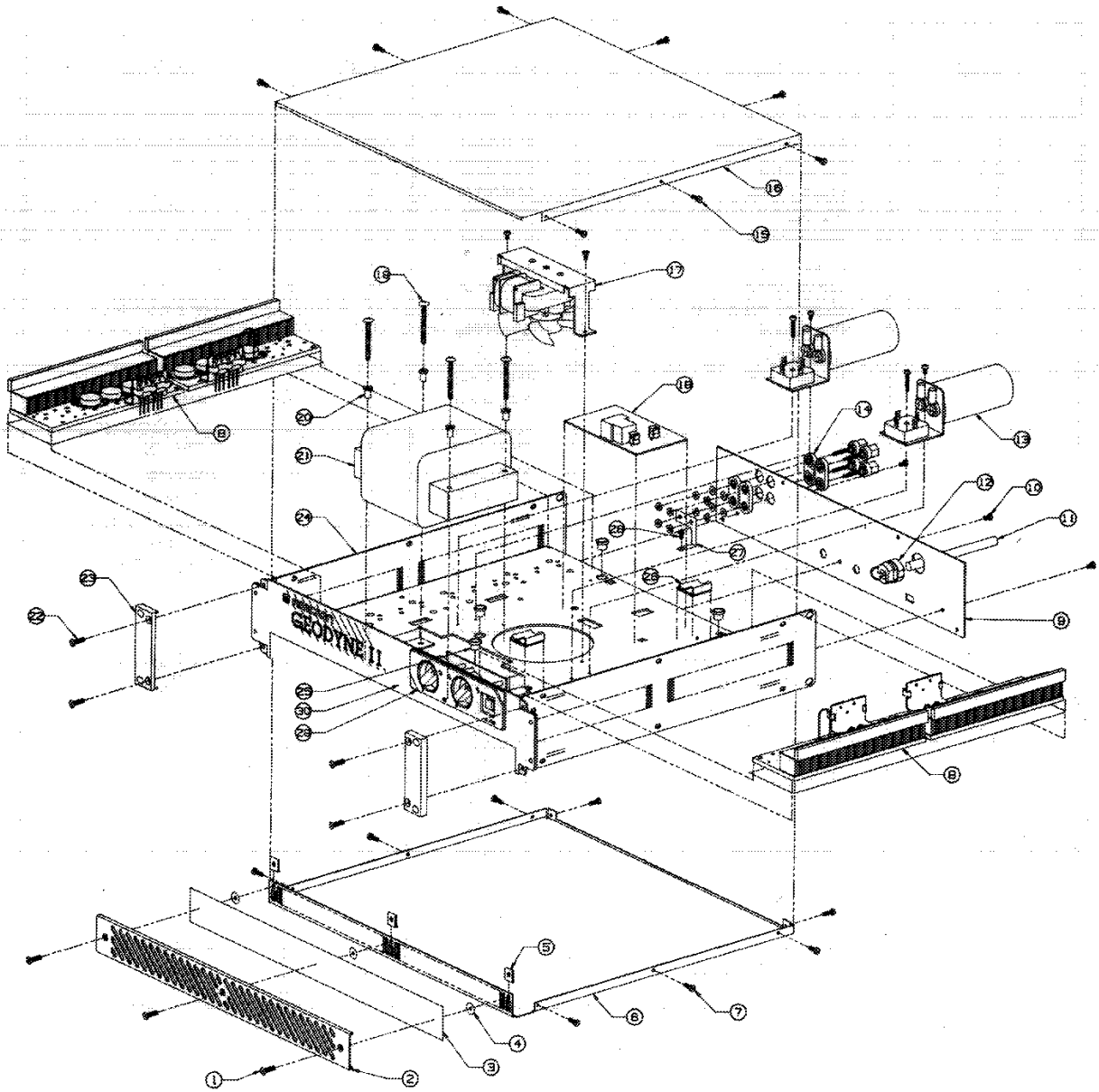


Fig. 7.1 Chassis Assembly (Top)

CHASSIS ASSEMBLY (TOP)

ITEM#	DESCRIPTION	PART #	QTY	NOTES
1	Fan Filter Screw	C 7036-4	3	
2	Metal Grill	F11923J3	1	
3	Foam Filter	D 6944-9	1	
4	Washer	C 7737-7	3	
5	Retainer Clip	C 7628-8	3	
6	Bottom Cover	F11394J7	1	
7	Cover Screw	D 7601-5	8	
8	Heatsink Assembly	_____	1	See Page 7-6
9	Back Panel	F11927J4	2	
10	Back Panel Screw	D 7601-5	3	
11	Power Cord	H43066-2	1	100V Nema
		H43066-2	1	120V Nema
		H43053-0	1	220V European
		H43064-7	1	240V UK
		H43128-0	1	Australia
12	Strain Relief	C 6800-4	1	100/120V
		C 7962-1	1	220/240V (IEC)
		C 7962-1	1	UK Power Cord
		_____	1	See Page 7-8
13	Capacitor Assembly	_____	1	
14	Dual Binding Post	C 2823-0	2	
15	Top Cover Screw	D 7601-5	9	
16	Top Cover	F11105J7	1	
17	Transmotor Assembly	_____	1	See Page 7-7
18	Control Module	_____	1	See Page 8-2
19	Transformer Screws	C 7666-8	4	
20	Shoulder Washer	C 7359-0	4	
21	Transformer	D 7599-0	1	
22	End Cap Screws	C 7036-4	4	
23	End Cap	F10966J3	2	
24	Geodyne II Chassis	M21000J0	1	
25	Snap Bushing	C 4014-4	4	
26	Cable Clamp	C 7705-4	2	
27	Circuit/Chassis Ground Strap	D 7600-6	1	
28	6-32 x .235 Torx Screw	D 7692-3	1	
29	Bezel Assembly	_____	1	See Page 7-9
30	Geodyne II Overlay	F12004J1	1	

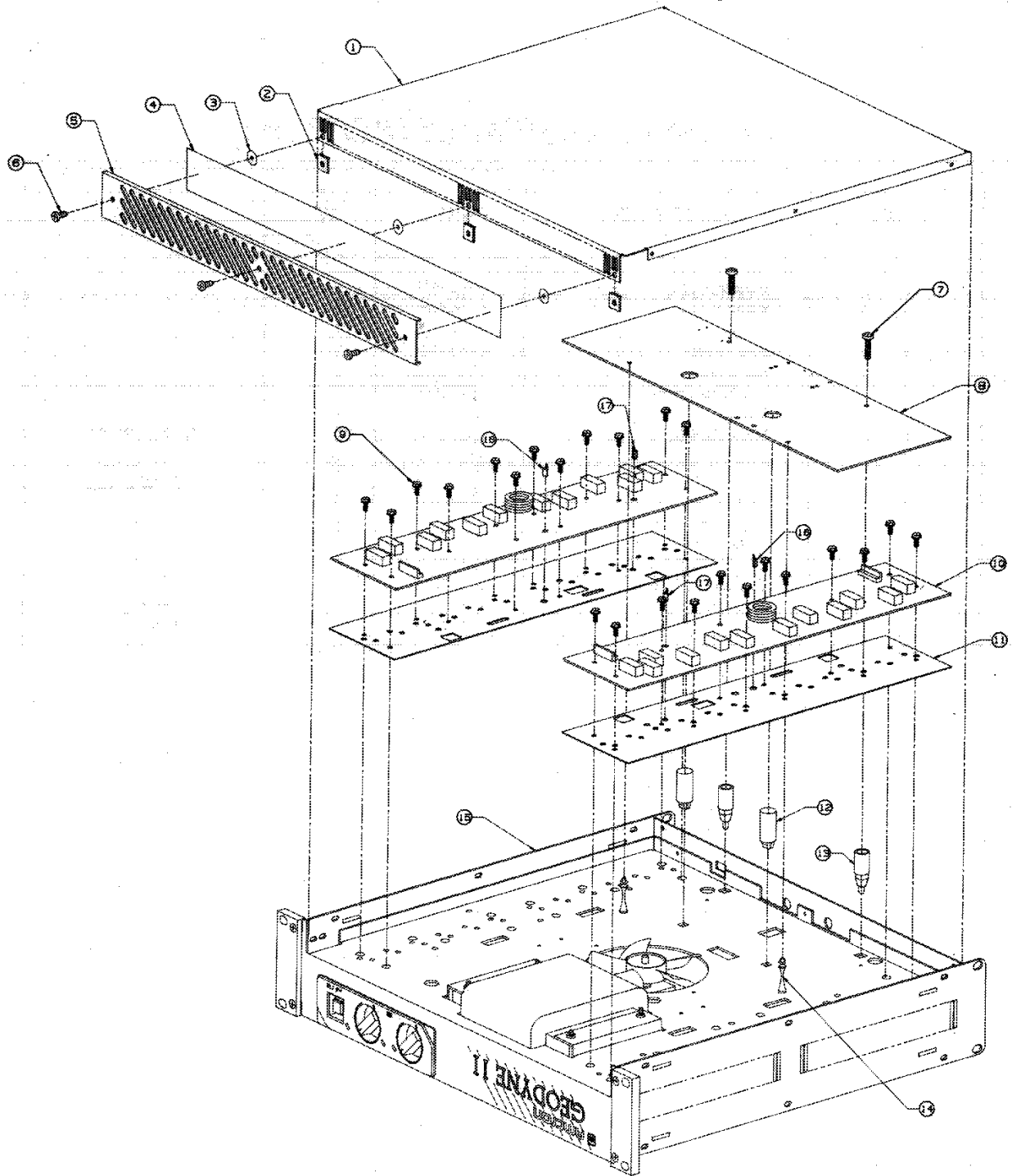


Fig. 7.2 Chassis Assembly (Bottom)

CHASSIS ASSEMBLY (BOTTOM)

ITEM#	DESCRIPTION	PART #	QTY	NOTES
1	Bottom Cover	F11394J7	1	
2	Retainer Clip	C 7628-8	3	
3	Washer	C 7737-7	3	
4	Foam Filter	D 6944-9	1	
5	Metal Grill	F11923J3	1	
6	Fan Filter Screw	C 7036-4	3	
7	Screw	C 5257-8	2	
8	Main Module	Q42857-5	1	See Page 8-15
9	Screw	D 6315-2	24	
10	Output Module	Q42856-7	2	See Page 8-5
11	Sil Pad	D 6280-8	2	
12	Toggle Nut Spacer	C 6913-5	2	25.4mm (1 inch)
13	Toggle Nut Spacer	C 6914-3	2	19mm (.75 inch)
14	Tension Support	C 6912-7	2	
15	Geodyne II Chassis	M21000J0	1	
16	MPS8097	C 8813-5	2	Alternate (MPSA18)
17	Thermal Sensor	C 5826-0	2	LM334Z

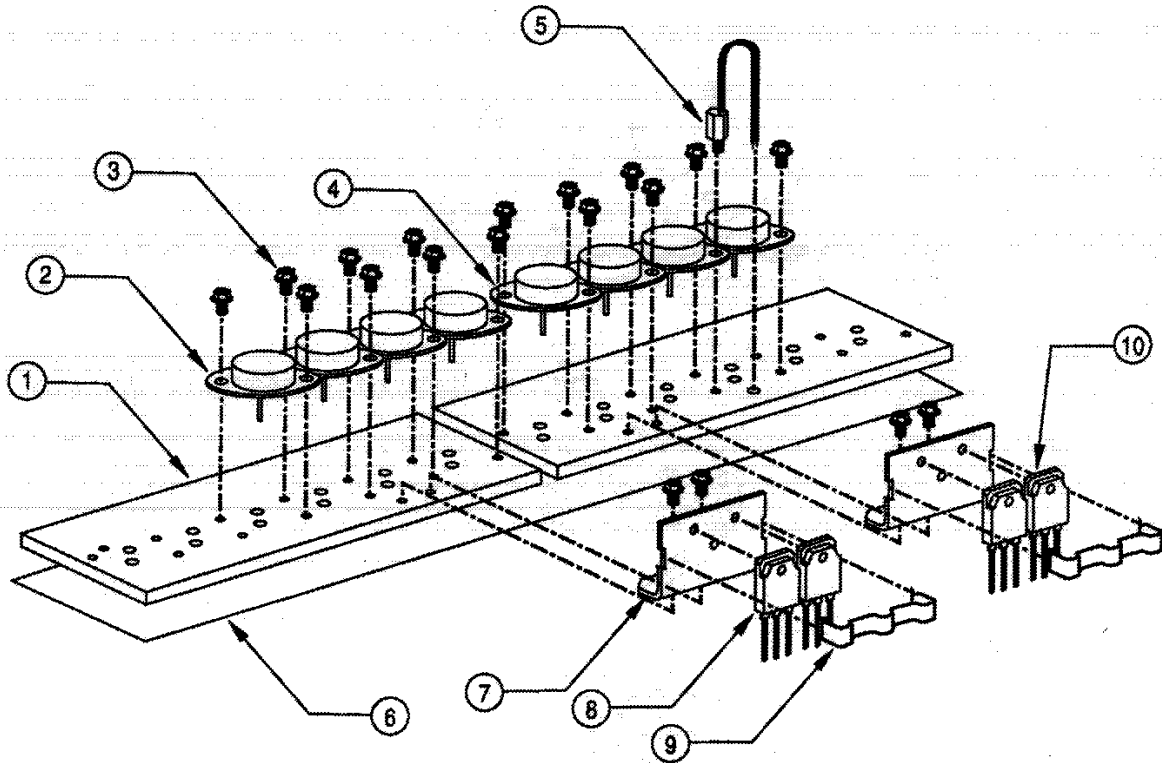


Fig. 7.3 Heatsink Assembly

HEATSINK ASSEMBLY

ITEM#	DESCRIPTION	PART #	QTY	NOTES
1	Heatsinks	F12053-9	4	Selected
2	MJ15015 NPN	C 4751-1	4	
3	6-32 X.235 Torx	D 6315-2	19	
4	MJ15016 PNP	C 6492-0	4	Selected
5	PTC	D 6591-8	1	95C
6	Output Pad	D 7597-4	1	
7	Driver Bracket	F11925-9	2	
8	MJ15028 NPN	C 5890-6	2	
9	Driver Clip	C 8531-3	2	
10	MJ15029 PNP	C 6493-8	2	

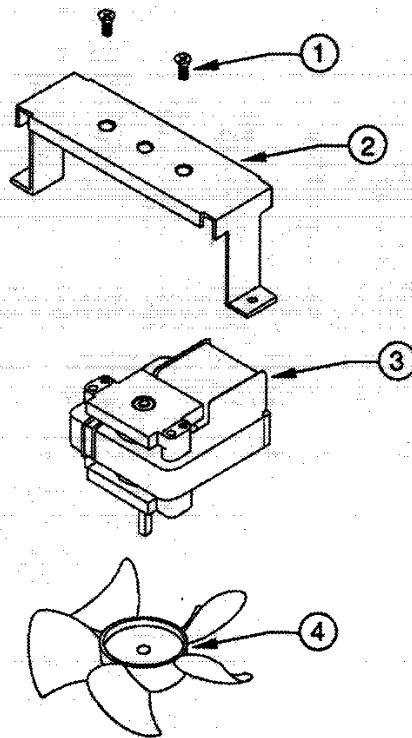


Fig. 7.4 Transmotor Assembly

TRANSMOTOR ASSEMBLY

ITEM#	DESCRIPTION	PART #	QTY	NOTES
1	6-32 x .3125 Screw	C 7062-0	2	
2	Fan Bracket	F11106-6	1	
3	Fan Motor	H43055-5	1	100V
		H43065-4		120V
		H44654-8		220/240V
4	Fan Blade (4 inch /10.16 cm)	C 6497-9	1	

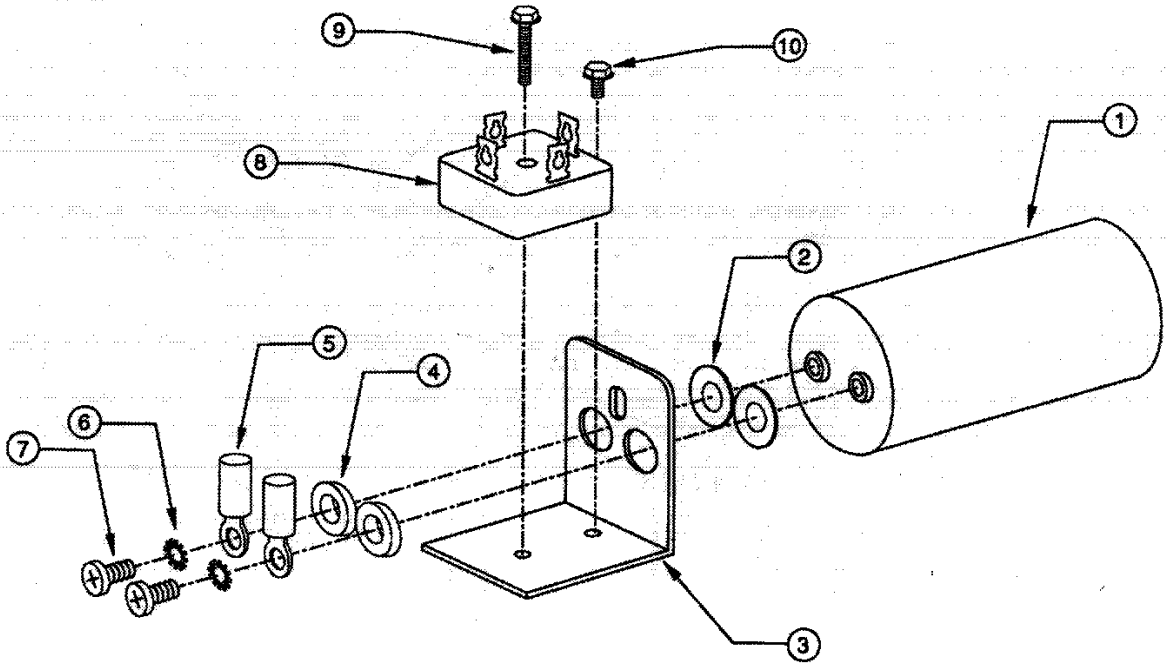


Fig. 7.5 Capacitor Assembly

CAPACITOR ASSEMBLY

ITEM#	DESCRIPTION	PART #	QTY	NOTES
1	10000 μ FD 100V	C 8433-2	1	
2	Fiber Washer	D 7142-9	2	
3	Capacitor Bracket	F12137-0	1	
4	Shoulder Washer	D 6764-1	2	
5	Connector	C 7352-5	2	
6	Lockwasher	C 6860-8	2	
7	10-32 X .37 TRHD	C 4013-6	2	
8	35A Bridge Rectifier	C 4305-6	1	
9	6 x 32 x .75 Hex	C 6964-8	1	
10	.320 Hex Tri-Lob	D 6291-5	1	

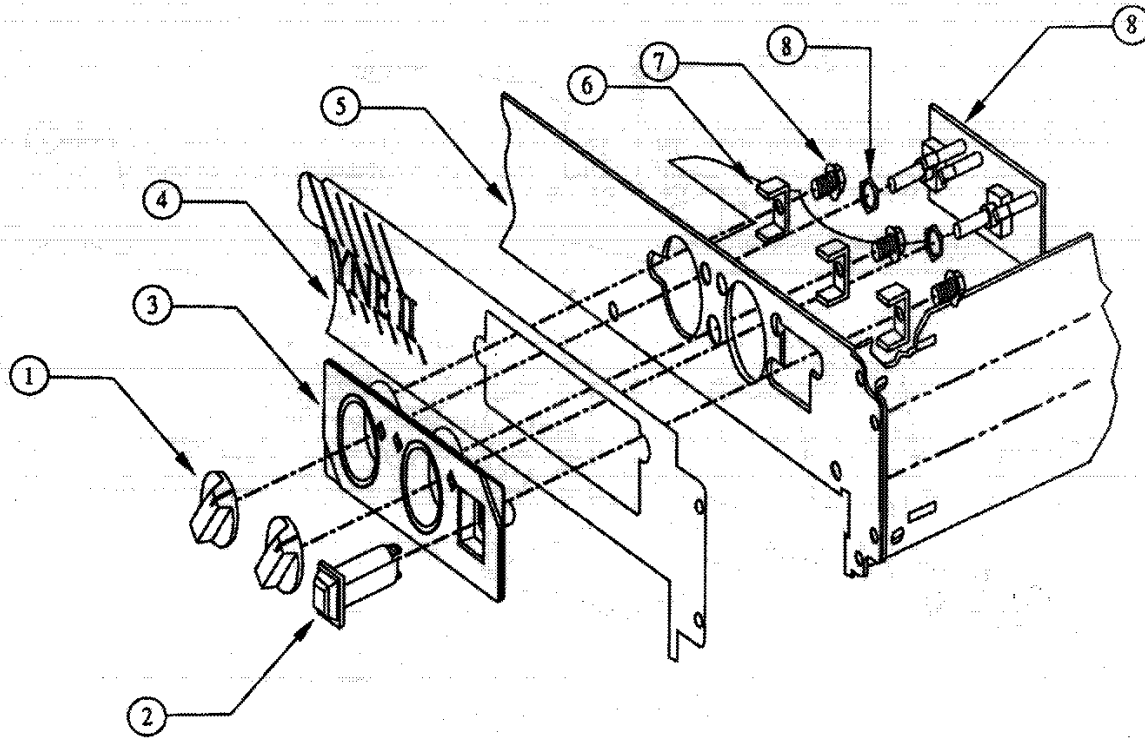


Fig. 7.6 Display Bezel Assembly

DISPLAY BEZEL ASSEMBLY

ITEM#	DESCRIPTION	PART #	QTY	NOTES
1	Knob	D 7587-5	2	220/230/240 (8 Amp) 100/120V (16 Amp)
2	Switch/Circuit Breaker	C 8535-4	1	
3	Plastic Bezel	C 8561-0	1	
4	Geodyne II Overlay	D 7588-3	1	
5	Chassis	F12004J1	1	
6	Front Panel Bezel Bracket	F11926-7	3	
7	8-18 x .5	D 6315-2	3	
8	LED/Level Board Assembly		1	See Page 7-10

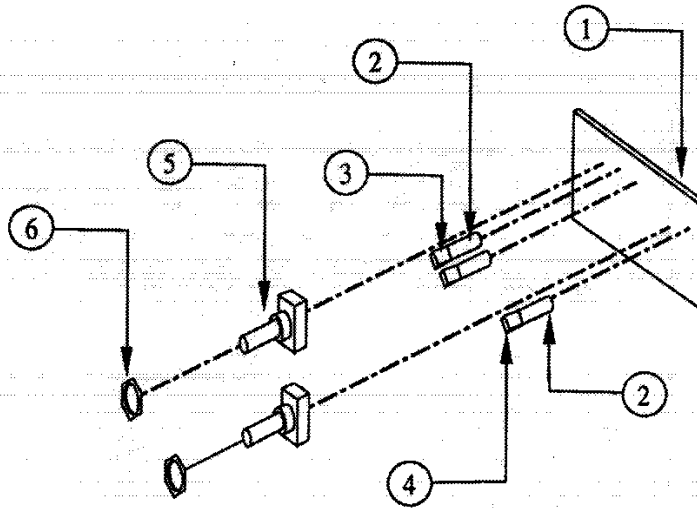


Fig. 7.7 LED/Volume Board Assembly

LED/VOLUME BOARD ASSEMBLY

ITEM#	DESCRIPTION	PART #	QTY	NOTES
1	Circuit Board	P10292-4	1	
2	LED Spacer	C 8585-9	2	
3	Amber LED	C 8527-1	2	
4	Red LED	C 8525-5	1	
5	Level Control	C 8470-5	2	
6	Level Control Nut (Comes with Level Control)			

AC LINE VOLTAGE SELECTION TABLE

PRIMARY TRANSFORMER WINDING	CONTROL BOARD CONNECTIONS			
#1	P804-1	P804-3	P804-3	P804-3
#2	P804-1	P804-2	P804-2	P804-2
#3	P804-2	P804-1	P804-1	P804-1
#4	P804-B	P804-B	P804-B	P804-B
#5	P804-S	P804-S	P804-S	P804-S
#6	P804-B	P804-S	P804-B	P804-S
AC LINE VOLTAGE	100V	120V	220/230V	240V
TRANSFORMER C.P.N.	07278-7 06803-7			D6804-5

LEGEND

1	BLACK #1	21	BROWN
2	BLACK #2	22	BLUE
3	BLACK #3	23	GREEN
4	BLACK #4	24	R18-CBL
5	BLACK #5	25	R18-CBL
6	BLACK #6	26	RED
7	RED #7	27	BLACK
8	RED #8	28	BLACK
9	BLUE #9	29	BLACK
10	BLUE #10	30	RED
11	GRAY-CBL	31	BLUE
12	GRAY-CBL	32	RED
13	BLACK	33	BLUE
14	BLACK	34	RED
15	BLUE	35	RED
16	RED	36	BLUE
17	BLUE	37	WHITE
18	RED		
19	BLACK		
20	BLACK		

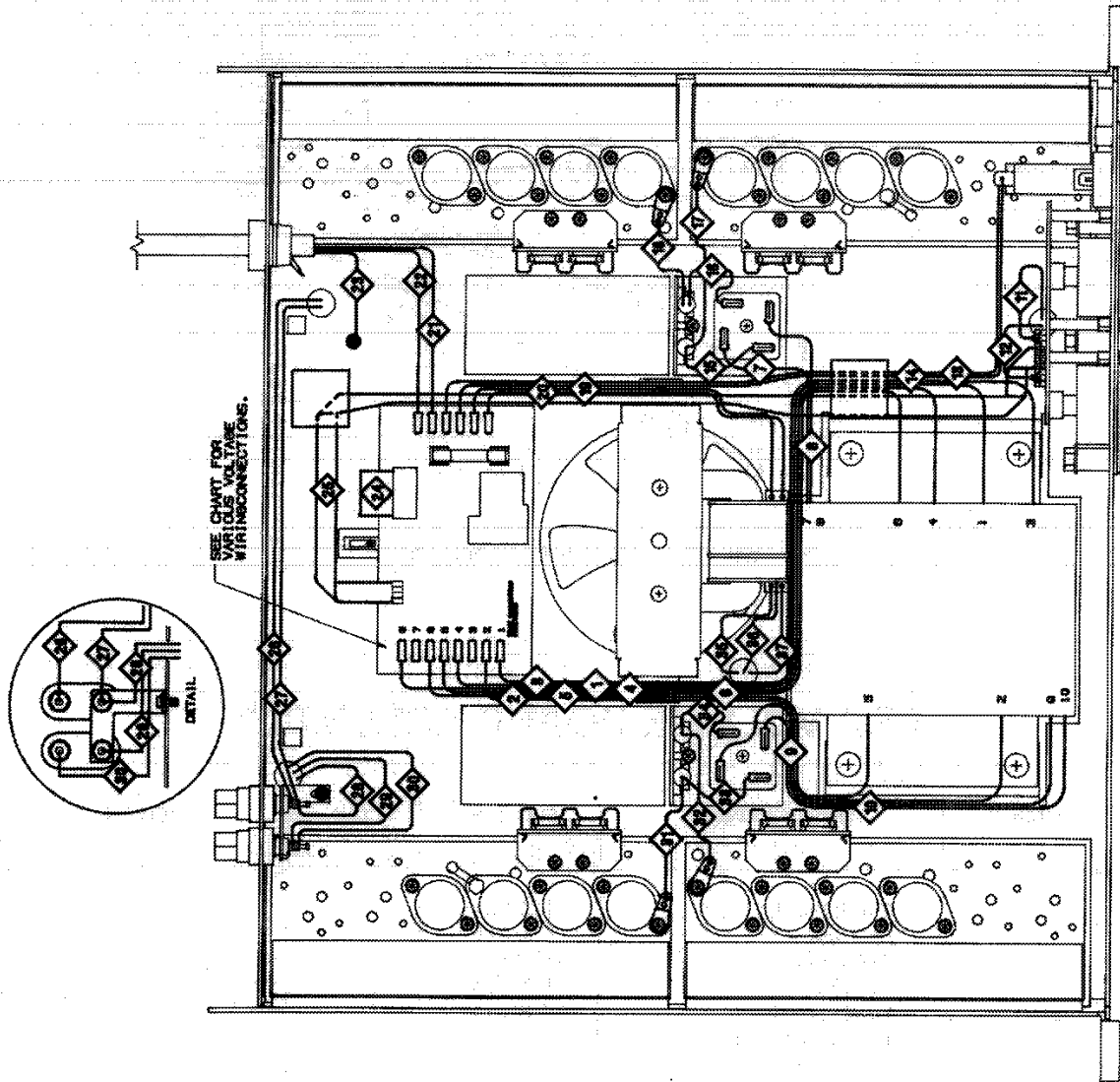


Fig. 7.8 Wiring Diagram (Top)

LEGEND	
1	BROWN
2	RIB - CBL
3	RED
4	BLACK
5	RIB - CBL
6	RED
7	WHITE
8	BLUE
9	RIB - CBL
10	GRAY
11	GRAY
12	RIB - CBL
13	RED
14	BLACK
15	RIB - CBL
16	WHT/BRN
17	BLACK

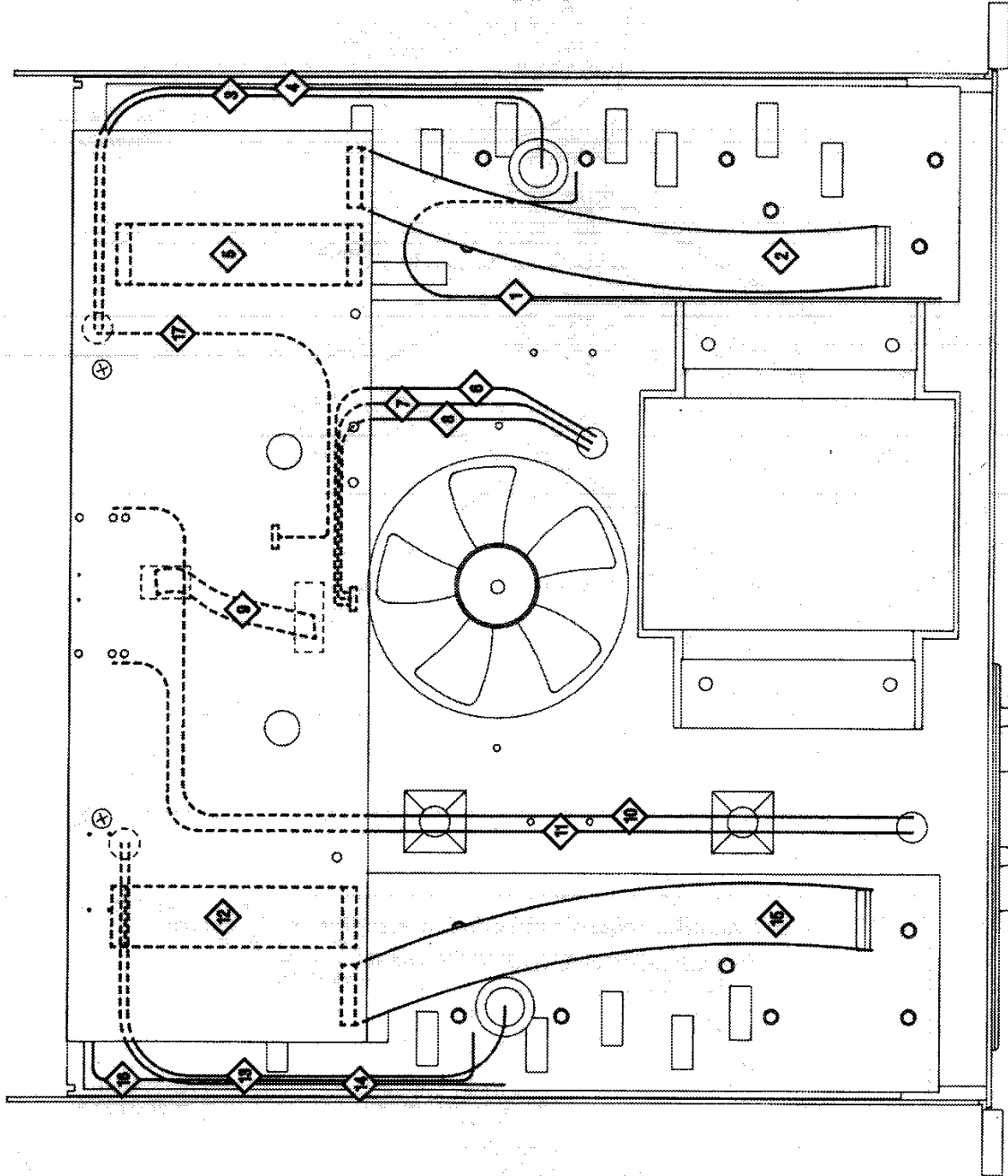


Fig. 7.9 Wiring Diagram (Bottom)

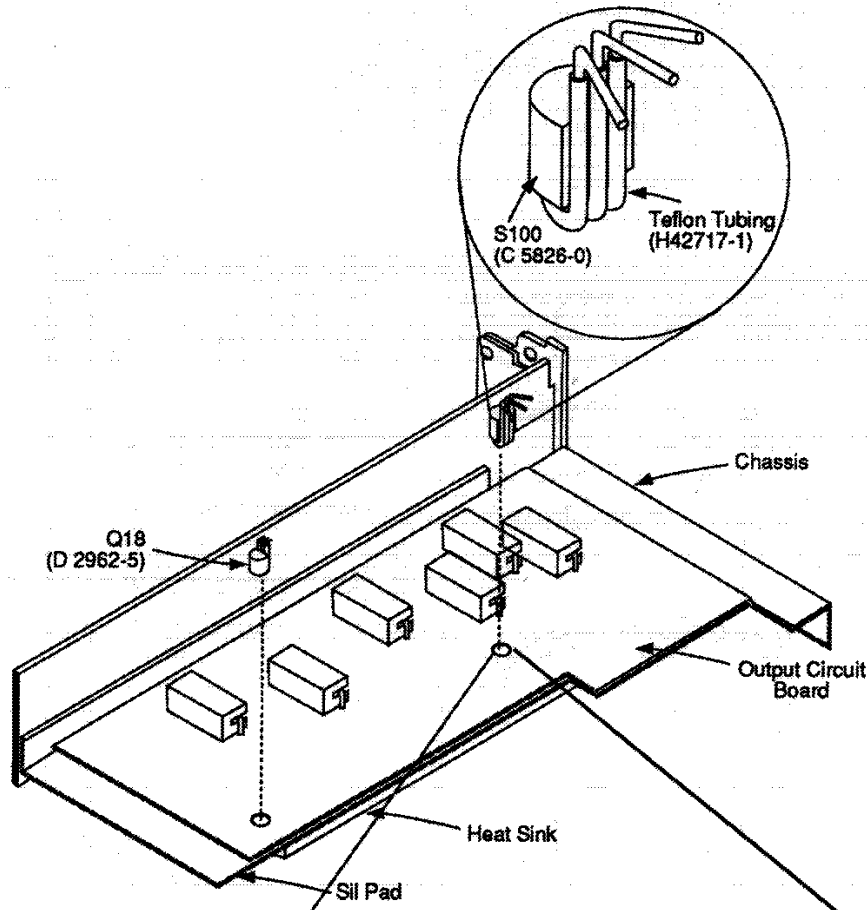
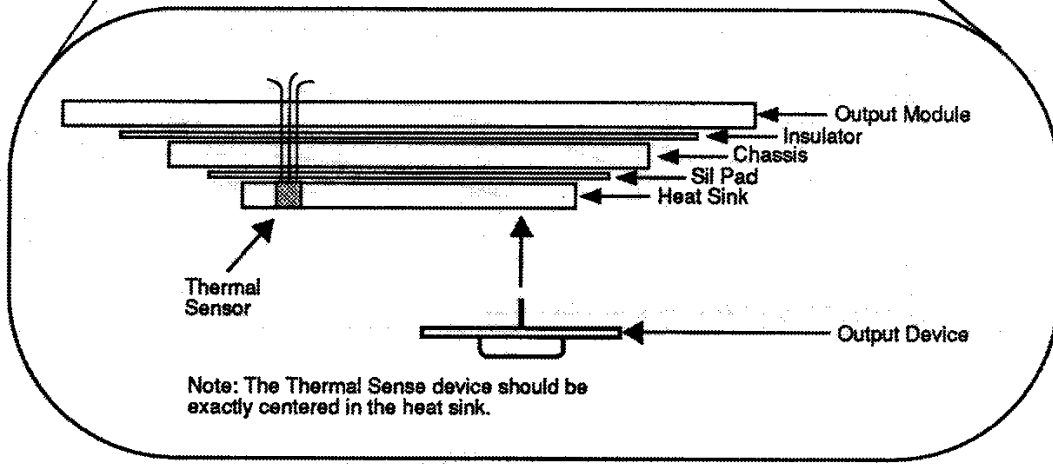


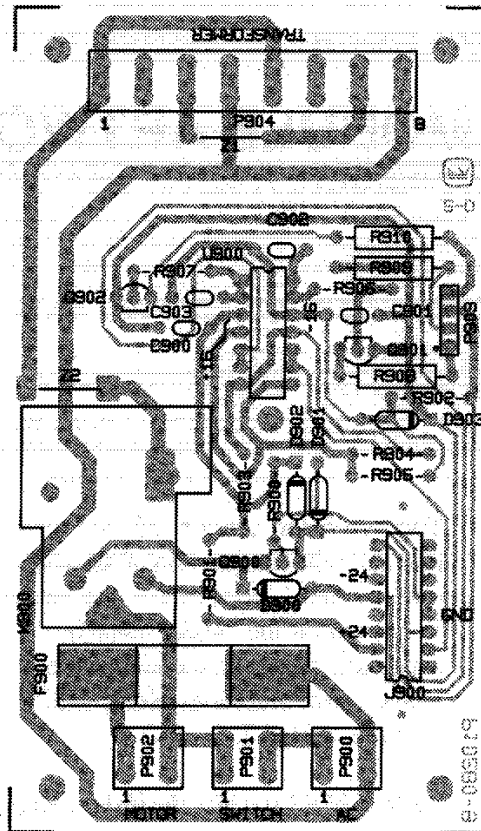
Fig. 7.10 Thermal IC Mounting



8 MODULE ARTWORK

The *Modules* section of this service manual is the compilation of artwork and circuit board layouts for the module found within the Model amplifier. For schematic diagrams see section 6 and for chassis parts drawings along with parts lists see section 7.

Note: A blank space in the right column of the following parts list means the component is the same as on the module listed immediately to the left! All resistors are .25W 5% unless otherwise noted.



* Darker tracework indicates parts side of module foil layout.
 ** Lighter tracework indicates bottom side of module foil layout.

Fig. 8.1 Control Module (Q42849-2)

CONTROL MODULE

Circuit Designation	Q42849-2		Description	Part #
	Description	Part #		
Capacitors				
C900	0.1 μ fd	C 6130-6		
C901	0.1 μ fd	C 6130-6		
C902	0.1 μ fd	C 6130-6		
C903	0.1 μ fd	C 6130-6		
Diodes				
D900	1N4148	C 3181-2		
D901	1N4148	C 3181-2		
D902	1N966B 16V	C 3533-4		
D903	1N966B 16V	C 3533-4		
Fuse				
F900	0.5 AMP	C 3841-1		
Semiconductors				
Q900	2N4125	C 3625-8		
Q901	2N4125	C 3625-8		
Q902	2N4125	C 3625-8		
Resistors				
R900	7.5K .25W	C 5769-2		
R901	1K .25W	C 2627-5		
R902	1K .25W	C 2627-5		
R903	39K .25W	C 6407-8		
R904	36K .25W	C 4865-9		
R905	39K .25W	C 6407-8		
R906	33K .25W	C 4346-0		

CONTROL MODULE (CONT)

Circuit Designation	Q42849-2		Description	Part #
	Description	Part #		
R907	33K ohm	C 4346-0		
R908	2.2K .5W	C 2628-3		
R909	3.3K .5W	C 2629-1		
R910	2.2K .5W	C 2628-3		
Integrated Circuits				
U900	LM339	C 4345-2		

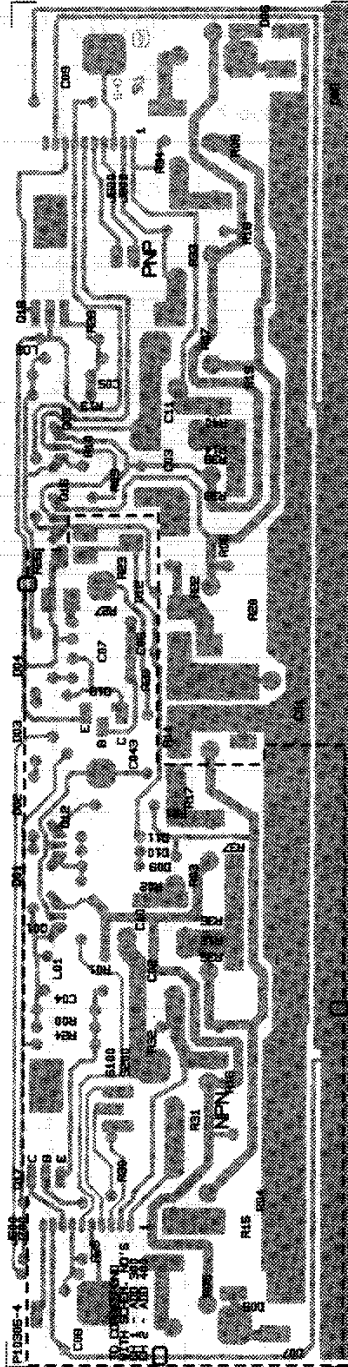


Fig. 8.2 Output Module (Q42856-7)

OUTPUT MODULE

Circuit Designation	Q42856-7		Description	Part #
	Description	Part #		
Resistors				
R300				
R400	75 ohm	C3798-3		
R301				
R401	470 ohm	C 2626-7		
R302				
R402	5.6 ohm	C 7778-1		
R303				
R403	.2 ohm 5W	C 6486-2		
R304				
R404	.2 ohm 5W	C 6486-2		
R306				
R406	.2 ohm 5W	C 6486-2		
R307				
R407	.2 ohm 5W	C 6486-2		
R309				
R409	22 ohm	C4479-9		
R310				
R410	470 ohm	C 2626-7		
R311				
R411	2.7 ohm 1W	C1001-4		
R312				
R412	12 ohm 1W	C 3931-0		
R313				
R413	75 ohm	C3798-3		
R314				
R414	12 ohm 1W	C 3931-0		
R316				
R416	.2 ohm 5W	C 6486-2		
R317				
R417	.2 ohm 5W	C 6486-2		
R319				
R419	.2 ohm 5W	C 6486-2		

OUTPUT MODULE (CONT)

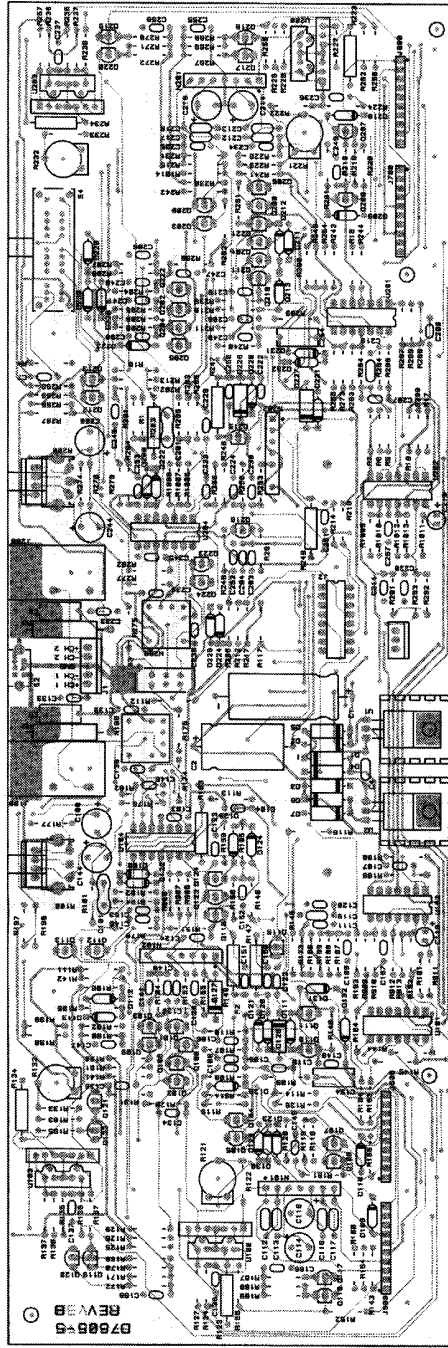
Circuit Designation	Q42856-7		Description	Part #
	Description	Part #		
R320 R420	.2 ohm 5W	C 6486-2		
R321 R421	5.6 ohm	C 7778-1		
R322 R422	22 ohm	C4479-9		
R323 R423	250 ohm Pot	C6844-2		
R324 R424	13K ohm	C4300-7		
R325 R425	2.2K ohm	C2628-3		
R326 R426	250 ohm Pot	C6844-2		
R327 R427	390 ohm	C6495-3		
R328 R428	13K ohm	C4300-7		
R329 R429	51 ohm	C6402-9		
R330 R430	102 ohm 1%	C6626-3		
R335 R435	12 ohm 1W	C 3931-0		
R336 R436	12 ohm 1W	C 3931-0		
R337 R437	12 ohm 1W	C 3931-0		
R338 R438	12 ohm 1W	C 3931-0		
R339 R439	12 ohm 1W	C 3931-0		

OUTPUT MODULE (CONT)

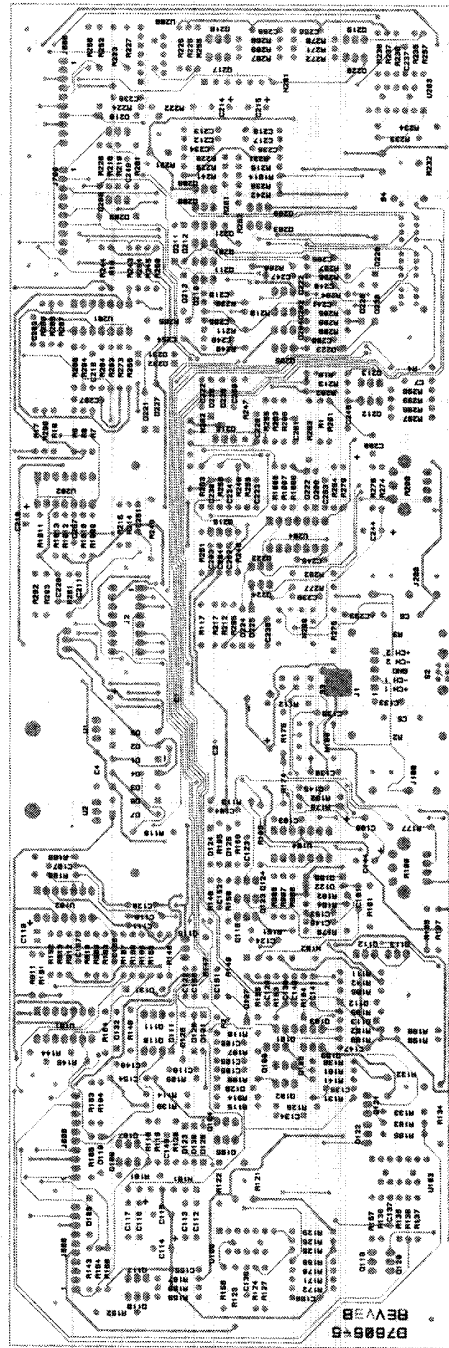
Circuit Designation	Q42856-7		Description	Part #
	Description	Part #		
R340 R440	12 ohm 1W	C 3931-0		
Capacitors				
C301 C401	.047 μ fd	C7838-3		
C302 C402	.22 μ fd	C3142-4		
C303 C403	.22 μ fd	C3142-4		
C304 C404	.0047 μ fd	C 6683-4		
C305 C405	.0033 μ fd	C 6684-2		
C306 C406	.01 μ fd	C 6687-5		
C307 C407	.001 μ fd	C2288-6		
C308 C408	180PF	C4295-9		
C309 C409	220PF	C 8208-8		
C343 C443	.01 μ fd	C 6687-5		
Diodes				
D301 D401	1N4004	C 2851-1		
D302 D402	1N4004	C 2851-1		
D303 D403	1N4004	C 2851-1		
D304 D404	1N4004	C 2851-1		

OUTPUT MODULE (CONT)

Circuit Designation	Q42856-7		Description	Part #
	Description	Part #		
D305 D405	1N4004	C 2851-1		
D306 D406	1N4004	C 2851-1		
D307 D407	1N4004	C 2851-1		
D308 D408	1N4004	C 2851-1		
D309 D409	1N4004	C 2851-1		
D310 D410	1N4004	C 2851-1		
D311 D411	1N4004	C 2851-1		
D312 D412	1N4004	C 2851-1		
Inductors				
L300 L400	Output Coil	D 6592-6		
L301 L401	.5 MH	C 3510-2		
L302 L402	.5 MH	C 3510-2		
Transistors				
Q317 Q417	MPS-U10	C 7271-7		
Q318 Q418	MPSA18	D 2962-5		
Q319 Q419	MPSU60	C 7318-6		
Misc				
	OUTPUT BOARD (BLANK)	P10305-4		



Component Side



Foil Side

Fig. 8.3 Main Module (Q42957-5)

MAIN MODULE

Circuit Designation	Q42857-5		Description	Part #
	Description	Part #		
Resistors				
R2	53.6K ohm	C 7365-7		
R4	46.4K ohm	C 7364-0		
R7	100K ohm	C 2883-4		
R8	20K ohm	C 5046-5		
R9	5.1K ohm	C 5163-8		
R10	0 ohm	C 5868-2		
R16	5.1K ohm	C 5163-8		
R17	20K ohm	C 5046-5		
R18	100K ohm	C 2883-4		
R101 R201	4.99K ohm 1W	C 3686-0		
R102 R202	510 ohm	C 4849-3		
R103 R203	100K ohm .5W	C 2324-9		
R104 R204	2.7K ohm	C 5168-7		
R105 R205	2.7K ohm	C 5168-7		
R106 R206	12K ohm	C 2878-4		
R107 R207	68K ohm	C 3620-9		
R108 R208	820 ohm	C 3301-6		
R109 R209	68 ohm	C 6079-5		

MAIN MODULE (CONT)

Circuit Designation	Q42857-5		Description	Part #
	Description	Part #		
R110 R210	68K ohm	C 3620-9		
R111 R211	12K ohm	C 2878-4		
R113 R213	4.7K ohm	C 3939-3		
R118 R218	270 ohm	C 6034-0		
R119 R219	300 ohm	C 3801-5		
R120 R220	270 ohm	C 6034-0		
R121 R221	100K ohm Pot	C 5062-2		
R122 R222	270K ohm	C 2885-9		
R123 R223	12K ohm .5W	C 7358-2		
R124 R224	6.8K ohm	C 5166-1		
R125 R225	100 ohm	C 2872-7		
R126 R226	100 ohm	C 2872-7		
R127 R227	6.8K ohm	C 5166-1		
R128 R228	10K ohm	C 2631-7		
R129 R229	100K ohm	C 2883-4		
R130 R230	100K ohm	C 2883-4		

MAIN MODULE (CONT)

Circuit Designation	Q42857-5			
	Description	Part #	Description	Part #
R131 R231	10K ohm	C 2631-7		
R132 R232	100K Pot	C 5062-2		
R133 R233	270K ohm	C 2885-9		
R134 R234	12K ohm .5W	C 7358-2		
R135 R235	100 ohm	C 2872-7		
R136 R236	6.8K ohm	C 5166-1		
R137 R237	100 ohm	C 2872-7		
R138 R238	6.8K ohm	C 5166-1		
R139 R239	820 ohm	C 3301-6		
R140 R240	68 ohm	C 6079-5		
R141 R241	150K ohm	C 4216-5		
R142 R242	150K ohm	C 4216-5		
R143 R243	100K ohm	C 2883-4		
R144 R244	100K ohm	C 2883-4		
R145 R245	2.7M ohm	C 2634-1		
R146 R246	12K ohm	C 2878-4		

MAIN MODULE (CONT)

Circuit Designation	Q42857-5		Description	Part #
	Description	Part #		
R147 R247	100 ohm .5W	C 1007-1		
R148 R248	2.7K ohm	C 5168-7		
R149 R249	100 ohm .5W	C 1007-1		
R150 R250	2.7K ohm	C 5168-7		
R151 R251	12K ohm	C 2878-4		
R152 R252	12K ohm	C 2878-4		
R153 R253	Ø ohm	C 5868-2		
R154 R254	121K ohm	C 5652-0		
R155 R255	1.3K ohm	C 3144-0		
R156 R256	1.3K ohm	C 3144-0		
R157 R257	1.3K ohm	C 3144-0		
R158 R258	9.1K ohm	C 5878-1		
R159 R259	1K ohm	C 2627-5		
R160 R260	10K ohm 1W	C 4859-2		
R161 R261	47 ohm	C 1011-3		
R162 R262	47 ohm	C 1011-3		

MAIN MODULE (CONT)

Circuit Designation	Q42857-5		Description	Part #
	Description	Part #		
R163 R263	121K ohm	C 5652-0		
R164 R264	10K ohm 1W	C 4859-2		
R165 R265	121K ohm	C 5652-0		
R166 R266	2.7M ohm	C 2634-1		
R167 R267	1K ohm 1W	C 4850-1		
R168 R268	953 ohm	C 6317-9		
R170 R270	1K ohm	4850-1		
R171 R271	953 ohm	C 6317-9		
R173 R273	10K ohm	C 4859-2		
R174 R274	24.9K ohm	C 7155-2		
R175 R275	11 K ohm	C 6405-2		
R176 R276	24.9K ohm	C 7155-2		
R177 R277	30.9 K ohm	C 7806-0		
R179 R279	1.3K ohm	C 3144-0		
R180 R280	470 ohm	C 2626-7		
R181 R281	4.7K ohm	C 3939-3		

MAIN MODULE (CONT)

Circuit Designation	Q42857-5		Description	Part #
	Description	Part #		
R182 R282	22 ohm	C 4479-9		
R183 R283	2.4K ohm	C 3616-7		
R184 R284	470K ohm	C 4225-6		
R185 R285	2.4K ohm	C 3616-7		
R186 R286	2.7M ohm	C 2634-1		
R187 R287	36K ohm	C 4865-9		
R188 R288	36K ohm	C 4865-9		
R189 R289	27K ohm	C 5165-3		
R190 R290	2M ohm	C 3199-4		
R191 R291	33K ohm	C 4346-0		
R192 R292	10K ohm	C 2631-7		
R193 R293	10K ohm	C 2631-7		
R194 R294	100K ohm	C 2883-4		
R195 R295	3K ohm	C 3805-6		
R196 R296	4.7K ohm	C 3939-3		
R197 R297	10K ohm	C 2631-7		

MAIN MODULE (CONT)

Circuit Designation	Q42857-5		Description	Part #
	Description	Part #		
R198 R298	4.7K ohm	C 3939-3		
R199 R299	10K ohm	C 2631-7		
R906 R1006	150K ohm	C 4216-5		
R907 R1007	150K ohm	C 4216-5		
R908 R1008	150K ohm	C 4216-5		
R909 R1009	470K ohm	C 4225-6		
R910 R1010	470K ohm	C 4225-6		
R911 R1011	150K ohm	C 4216-5		
R912 R1012	470 ohm	C 2626-7		
R913 R1013	1M ohm	C 3198-6		
Resistor Networks				
N100 N200	Bal. Input Trim	C 4669-4		
N101 N201	Resistor Network	D 6081-0		
N102 N202	Resistor Network	D 6082-8		
Capacitors				
C1	1000 μ fd 35V	C 4303-1		
C2	470 μ fd 35V	C 4477-3		

MAIN MODULE (CONT)

Circuit Designation	Q42857-5		Description	Part #
	Description	Part #		
C4	.47 μ fd	C 6802-0		
C7	.1 μ fd	C 6804-6		
C100 C200	22NP	C 5311-3		
C101 C201	10PF	C 2821-4		
C103 C203	.022 μ fd	C 5230-5		
C104 C204	.022 μ fd	C 5230-5		
C105 C205	47PF	C 3409-7		
C106 C206	47PF	C 3409-7		
C107 C207	.1 μ fd	C 6804-6		
C108 C208	12PF	C 6814-5		
C109 C209	0.0033 μ fd	C 7417-6		
C110 C210	2.2 μ fd 50V	C 5362-6		
C111 C211	.1 μ fd	C 6804-6		
C112 C212	.12 μ fd	C 6803-8		
C113 C213	.47 μ fd	C 6802-0		
C114 C214	100 μ fd 35V	C 8026-4		
C115 C215	100 μ fd 35V	C 8026-4		

MAIN MODULE (CONT)

Circuit Designation	Q42857-5		Description	Part #
	Description	Part #		
C116 C216	.47 μ fd	C 6802-0		
C117 C217	.1 μ fd2	C 6803-8		
C118 C218	12PF	C 6814-5		
C119 C219	.47 μ fd	C 6802-0		
C120 C220	.1 μ fd	C 6804-6		
C122 C222	100PF	C 3410-5		
C123 C223	47PF	C 3409-7		
C124 C224	47PF	C 3409-7		
C129 C229	12PF	C 6814-5		
C130 C230	27PF	C 2342-1		
C133 C233	27PF	C 2342-1		
C134 C234	.022 μ fd	C 6805-3		
C135 C235	.022 μ fd	C 6805-3		
C136 C236	470PF	C 6808-7		
C137 C237	470PF	C 6808-7		
C138 C238	27PF	C 2342-1		

MAIN MODULE (CONT)

Circuit Designation	Q42857-5		Description	Part #
	Description	Part #		
C138 C239	27PF	C 2342-1		
C140 C240	47PF	C 3409-7		
C141 C241	47PF	C 3409-7		
C144 C244	100 μ fd 35V	C 8026-4		
C145 C245	47PF	C 3409-7		
C146 C246	47PF	C 3409-7		
C147 C247	.01 μ fd	C 6806-1		
C148 C248	180PF	C 4295-9		
C149 C249	470PF	C 6808-7		
C150 C250	.01 μ fd	C 6806-1		
C151 C251	.01 μ fd	C 6806-1		
C152 C252	82PF	C 3627-4		
C153 C253	.1 μ fd	C 6804-6		
C154 C254	.1 μ fd 250V	C 8426-6		
C155 C255	.1 μ fd	C 6804-6		

MAIN MODULE (CONT)

Circuit Designation	Q42857-5		Description	Part #
	Description	Part #		
C156 C256	.1 μ fd	C 6804-6		
C157 C257	.01 μ fd	C 6806-1		
Integrated Circuits				
U1	7815	C 5095-2		
U2	7915	C 5096-0		
U100 U200	UPA75	C 6911-9		
U101 U201	LM339	C 4345-2		
U102 U202	LM339	C 4345-2		
U103 U203	UPA76	C 6910-1		
U104 U204	33079	C 7558-7		
Transistors				
Q100 Q200	2N3859A	D 2961-7		
Q101 Q201	MPSA93	C 3578-9		
Q102 Q202	MPSA43	C 3810-6		
Q103 Q203	PN4250	C 3786-8		
Q105 Q205	MPSA93	C 3578-9		
Q106 Q206	2N4125	C 3625-8		

MAIN MODULE (CONT)

Circuit Designation	Q42857-5		Description	Part #
	Description	Part #		
Q107 Q207	PN4250	C 3786-8		
Q108 Q208	2961	D 2961-7		
Q109 Q209	2961	D 2961-7		
Q110 Q210	MPSA43	C 3810-6		
Q112 Q212	2N4125	C 3625-8		
Q113 Q213	2N4125	C 3625-8		
Q115 Q215	MPS8097	D 2962-5		
Q116 Q216	PN4250	C 3786-8		
Q117 Q217	2N3859A	D 2961-7		
Q118 Q218	2N3859A	D 2961-7		
Q119 Q219	2N4125	C 3625-8		
Q120 Q220	2N4125	C 3625-8		
Q121 Q221	2N4123	C 7458-0		
Q122 Q222	2N4123	C 7458-0		
Q123 Q223	2N4123	C 7458-0		
Q124 Q224	2N4125	C 3625-8		

MAIN MODULE (CONT)

Circuit Designation	Q42857-5		Description	Part #
	Description	Part #		
Diodes				
D1	1N4004	C 2851-1		
D2	1N4004	C 2851-1		
D3	1N4004	C 2851-1		
D4	1N4004	C 2851-1		
D5	1N4004	C 2851-1		
D6	1N4004	C 2851-1		
D7	1N4004	C 2851-1		
D108 D208	1N4148	C 3181-2		
D109 D209	1N4148	C 3181-2		
D110 D210	1N4148	C 3181-2		
D111 D211	1N3070	C 5061-4		
D112 D212	1N4148	C 3181-2		
D113 D213	1N4148	C 3181-2		
D117 D217	MDA3502	C 4305-6		
D120 D220	1N4148	C 3181-2		
D121 D221	1N4148	C 3181-2		
D122 D222	1N4148	C 3181-2		
D123 D223	1N3070	C 5061-4		

MAIN MODULE (CONT)

Circuit Designation	Q42857-5		Description	Part #
	Description	Part #		
D124 D224	1N4148	C 3181-2		
D125 D225	1N4148	C 3181-2		
D126 D226	1N3070	C 5061-4		
D127 D227	1N3070	C 5061-4		
D1229 D229	1N4148	C 3181-2		
D130 D230	1N4148	C 3181-2		
D131 D231	1N4148	C 3181-2		
D132 D232	1N4148	C 3181-2		

MAIN MODULE (CONT)

Circuit Designation	Q42857-5		Description	Part #
	Description	Part #		
MISC.	6X32 Hex Nut	C 1889-2		
	6-32 X .50 RDHD	C 2176-3		
	IC Socket, 14Pin	C 3450-1		
	IC Socket, 16Pin	C 4508-5		
	TO220 Heat Sink	C 5341-0		
	#6 INT. Star Washer	C 5594-4		
	S2	Ground Lift Switch	C 7363-2	
S3	Sensitivity Switch	C 6851-7		
S4	Dual/Mono Switch	C 6781-6		
	3POS. Header	C 7526-4		
	10" Ribbon Cable	D 6619-7		
	6" Ribbon Cable	D 6620-5		
	Circuit Board (Blank)	D 6988-6		