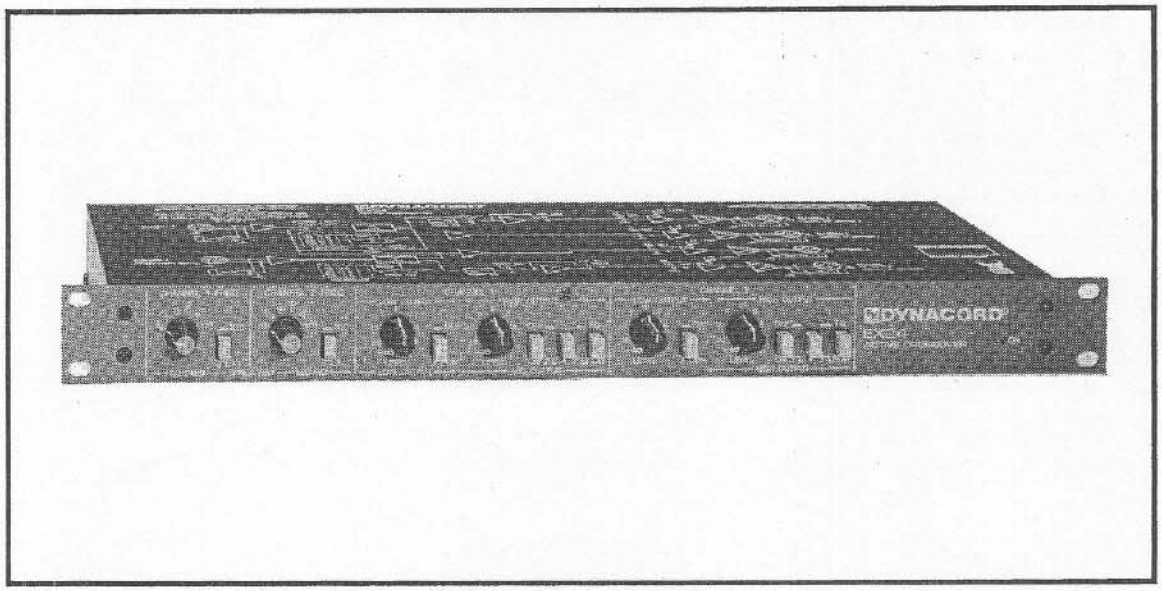
# DYNACORD®

## EX24 Active Crossover

OPERATING AND SERVICE INSTRUCTIONS



## 1 INSTALLATION

### 1.1 Rack Mounting

The crossover may be installed in a standard 19 inch equipment rack. It requires 1.75 inches of vertical space and mounting is accomplished by using the four screws supplied.

### 1.2 Ventilation

The crossover should not be used in areas where the ambient temperature exceeds 60°C (140°F).

## 2 SIGNAL CONNECTIONS

### 2.1 Input Connections

Balanced input connections may be made to either the female 3-pin XLR-type or the ¼" phone (TRS) connector. For single-ended inputs, strap the low (-) input to ground (pin 3 on XLR or *Ring* on ¼" phone). Otherwise, the electronically differential balanced input stage will see 6 dB less input signal level than with a balanced input. Refer to Figure 1 for typical input connections.

### 2.2 Output Connections

The outputs of the crossover are electronically servo-balanced. Balanced output connections may be made to either the male 3-pin XLR-type or the ¼" phone (TRS) connectors. For single-ended outputs, strap the low (-) output to ground (pin 3 on the XLR or *Ring* on ¼" phone). Otherwise, the electronically servo-balanced output stage will produce 6 dB less output signal level than with a balanced output. Refer to Figure 2 for typical output connections.

## 3 OPERATION

### 3.1 Front Panel Controls and Indicators

(Refer to Figure 3.)

1. *CHANNEL 1 and 2 FREQUENCY CONTROLS:* These frequency controls set the channel crossover frequencies. At this frequency both crossover outputs are 6 dB down from their passband levels. The crossover frequency may be adjusted from 80 Hz to 6.3 kHz. In the two-way mode, each frequency control is independent of the other. In the three-way mode, the Channel 1 control adjusts the low-to-mid crossover frequency and the Channel 2 control adjusts the mid-to-high crossover frequency.

2. *RANGE SWITCHES:* The range switches shift the range of each respective frequency control by a factor of 10 (when pressed, multiply the front panel marking by 10). With this switch depressed, the range of the crossover frequency control becomes 800 Hz to 6.3 kHz. This allows the selection of crossover points desired in two- and three-way systems. These switches should not be changed when the amplifiers are on.

3. *LEVEL CONTROLS:* The level controls set the output levels of the high- and low frequency outputs. They should be set for the most pleasing high frequency balance. In three-way operation, the Channel 1 high frequency control adjusts the midrange output and the Channel 2 high frequency control adjusts the high frequency output. Again, they should be set for the most pleasing musical balance. In both cases, this should be done with other system equalization (output channel of graphic) set flat.

4. *OUTPUT ON/OFF SWITCHES:* These switches turn the output on and off. This is useful for testing and setup when it is necessary to hear the outputs separately.

5. *POLARITY SWITCHES:* The polarity switches reverse the polarity of their respective output. For two-way operation, the high frequency outputs are controlled. For three-way operation, the midrange and high frequency outputs are controlled. Operating the polarity switch is similar to reversing the wires at the loudspeaker terminals. The polarity switch allows instant determination of the system's phasing at the crossover frequency. The normal setting of the polarity switch is the out (+) position. This results in the flattest frequency response for most loudspeaker systems, when the drivers are physically time-aligned.

6. *HORN EQ SWITCHES:* The horn EQ switches turn on equalization for constant-directivity horns. The horn EQ should not be used with the older radial-type horns. It is also not used for passively crossed-over mid-high sections, such as the EV/DYNACORD **SH1810** in bi-amp mode, or when subwoofers are used with full-range loudspeakers in bi-amp (two-way) mode.

### 3.2 Rear Panel Controls and Connections

(Refer to Figure 4.)

1. *IEC CONNECTOR:* This connector is for the supplied three-prong power cord.

2. *FUSE HOLDER:* The fuse holder requires a 175 mA/250 V Slo-Blo® fuse with 120 Vac line.

3. *HIGH, LOW, and MID CHANNEL OUTPUTS:* These 3-pin XLR-type and ¼" phone jacks are electronically servo-balanced outputs. These connectors are compatible with both balanced and unbalanced connections.

4. *MONO LOW/STEREO LOW:* The mono low switch sums together the low outputs from both channels if depressed. This is necessary with single-channel subwoofer systems or for maximizing low frequency output for stereo setups.

5. *MONO 3-WAY/STEREO 2-WAY MODE SWITCH:* This switches between the mono three-way mode of operation or the stereo two-way mode of operation.

6. *CHANNEL 1 and CHANNEL 2 INPUTS:* These input are electronically differential balanced and are compatible with both balanced and unbalanced connections.

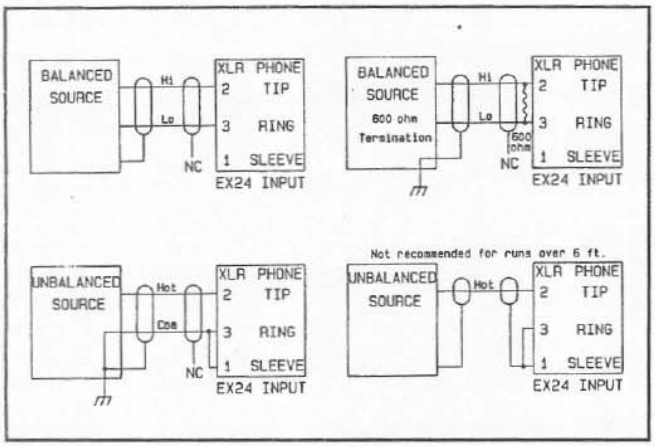



**Figure 1:** Typical Input Connections

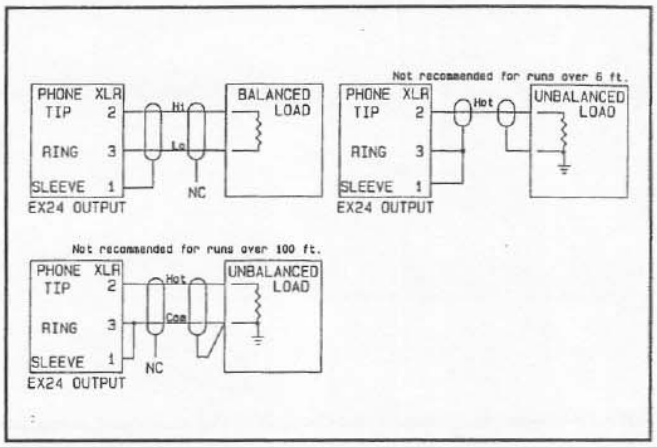



**Figure 2:** Typical Output Connections

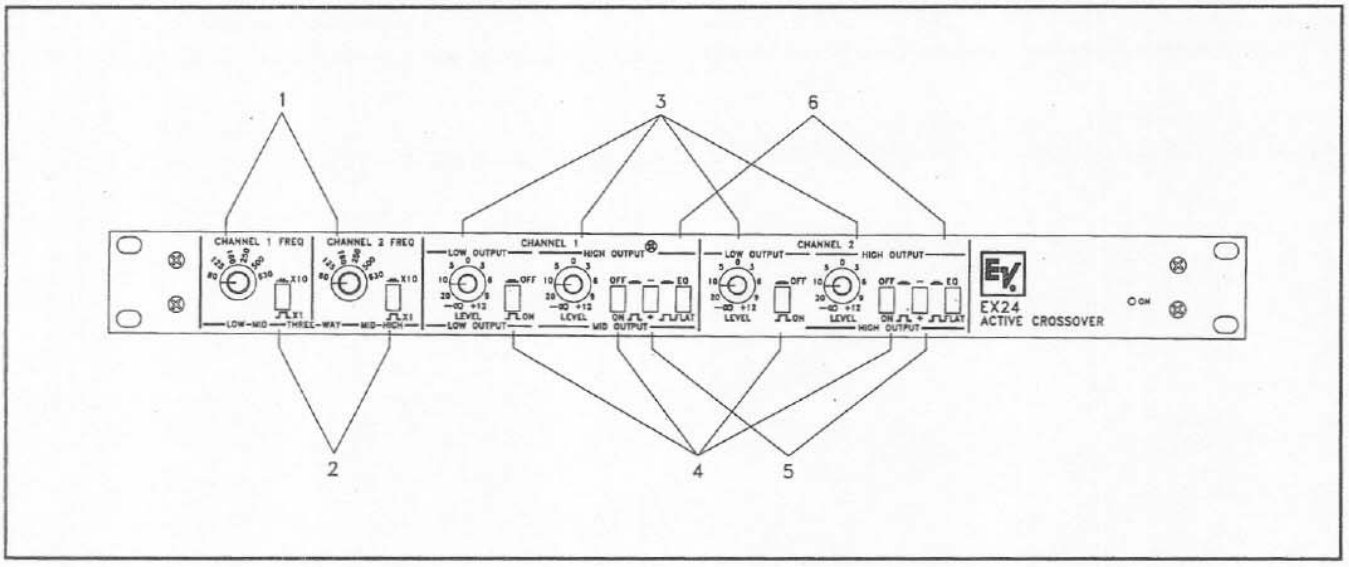



**Figure 3:** Front Panel Diagram

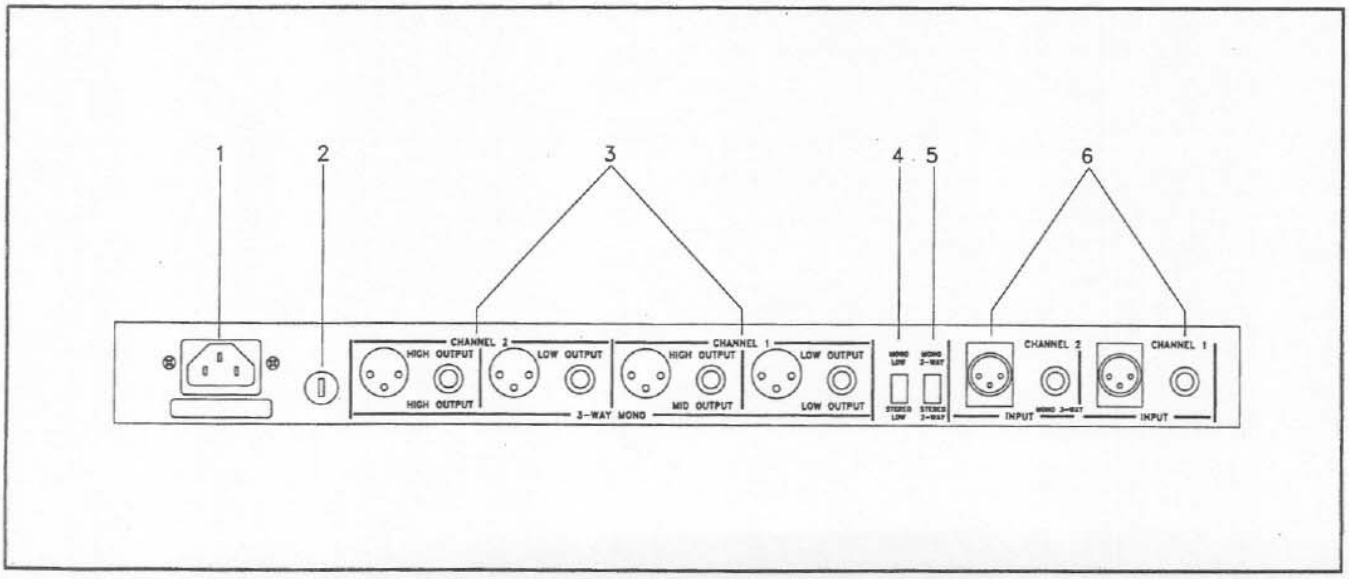



**Figure 4:** Rear Panel Diagram

## 4 SET-UP PROCEDURE

1. Ensure that all power amplifiers are off.
2. Check the loudspeaker connections. Be certain that the high frequency amplifier actually feeds the high frequency loudspeakers and that the low frequency amplifier actually feeds the low frequency loudspeakers.
3. Select proper mode(s) and crossover frequency(s) for the system. Consult the loudspeaker manufacturer for choice of crossover frequency. If constant-directivity horns are used (without passive crossover/EQ) then switch on the appropriate channel horn EQ.
4. Switch off all outputs on the crossover. Set gain controls to 0 dB (center detent).
5. Turn on the crossover, mixer(s), and signal processing equipment.
6. Set any overall system equalization (graphic, parametric, or other) to flat.
7. Turn on the power amplifiers.
8. Feed a signal to the crossover input. Switch on the high frequency outputs on the crossover. Slowly advance the high frequency power amplifier level control. Check to be sure that the sound heard is actually coming from the high frequency loudspeakers. The power amplifier level control should be left between full up and about 12 dB down from that, depending on the amplifier's sensitivity. Typically, turning the amplifier down about 6 dB from full up (a sensitivity of about +10 dBu) will reduce the system noise level while maintaining clean sound. Switch off the high output(s).
9. Repeat steps 7 and 8 with the mid output (if used) and then the low output(s).
10. When all outputs are functional and amplifier levels are set, switch on all of the outputs.
11. Using a wide-range signal source, adjust the crossover level controls for proper frequency balance.
12. Remember, when using the system, always switch the power amplifiers **on last and off first**.

## 5 APPLICATIONS

For most sound system applications, bi- or tri-amplification can provide a significant performance advantage over conventional passive crossovers. A bi-amplified system (Figure 5) uses a separate power amplifier for each loudspeaker (woofer and tweeter) in the system. Similarly, the tri-amplified system (Figure 6) would require three amplifiers. The crossover is placed before the amplifiers and after the mixer, preamplifier, or equalizer. Thus, each amplifier need only handle the frequency range of its respective loudspeaker(s). This arrangement allows each loudspeaker(s) to be driven by an amplifier that exactly suits the needs of that particular loudspeaker. For a low frequency loudspeaker, this means having enough power to insure adequate low frequency headroom. The absence of the passive crossover eliminates the crossover network unit's insertion loss and improves the damping factor seen by the woofer. This improves low frequency performance allowing the woofers cone movement to be more precisely controlled.

Most high frequency loudspeakers are about 10 dB higher in efficiency than most low frequency loudspeakers. This means that for the same acoustical output level, the power requirements are about 10:1. For example, if the tweeter requires 10 watts for a given sound pressure level, the woofers will require 10 times more power to produce the same level (100 watts). Since the high frequency amplifier has limited power, it is less likely to damage the tweeters if a mistake occurs (dropped mic, loud feedback, etc.).

Musical signals demand the largest amount of power at low frequencies. This is compounded by the lower efficiency of most woofers. A passively crossed-over system requires tremendous amounts of power to accurately reproduce musical transients at real-life (live performance) levels. In this system, when a power amplifier clips, the only thing the loudspeaker system can do is to try to reproduce it. During the instant that the amplifier is clipped, all other signals going through it are also clipped. This means that all high frequency are lost. The clipping is heard as harsh distortion and is especially hard on the tweeters which are not equipped to handle the drastically changed energy content. This is probably the number one cause of tweeter burnout. In a bi-amplified system, when a large low frequency transient clips the low frequency amplifier, the accompanying high frequencies are not clipped because they have their own amplifier. The low frequency clipping is reproduced by the low frequency loudspeaker, but is masked by the clean highs coming out of the tweeter. The result is that the system will sound cleaner, longer.

## 6 HIGH FREQUENCY DRIVER PROTECTION

In any bi-, tri-, or multi-amplified system, it is especially important to provide low frequency roll-off for the high frequency loudspeakers. This protection can take the form of a series capacitor. The roll-off should occur at about one octave below the crossover point. This will help protect the driver from dc should the amplifier short out, or from low frequency energy if the high- and low frequency sends get switched around. To find the capacitor value, use the equation,

$$C = 10^6 / \pi f Z$$

where, C is the capacitor value in microfarads, f is the crossover frequency in hertz, and Z is the loudspeaker impedance in ohms.

Use (in order of preference) mylar or film, non-polar electrolytic or series-connected (+ to +, 2x the calculated value) polar or electrolytic capacitors with at least one having a 50 volt rating.

For the commonly used 16 ohm drivers: 500 Hz = 40 µF, 800 Hz = 24 µF, 1000 Hz = 20 µF. Eight-ohm drivers will require twice the capacitance of a 16 ohm driver: 500 Hz = 80 µF.

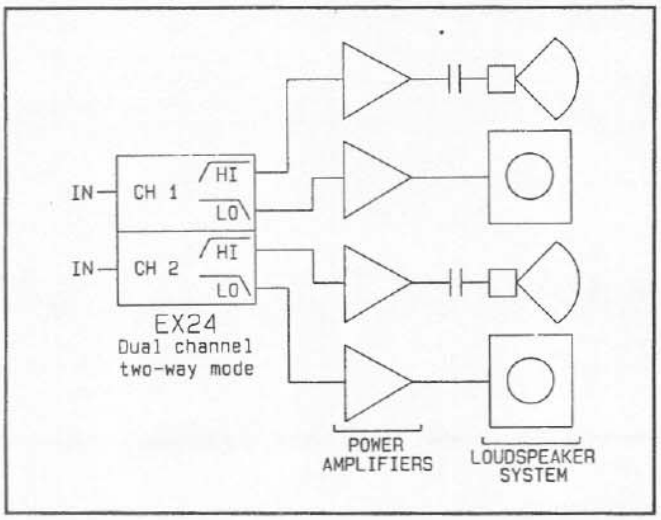



**Figure 5:** Typical Bi-Amplified Sound System

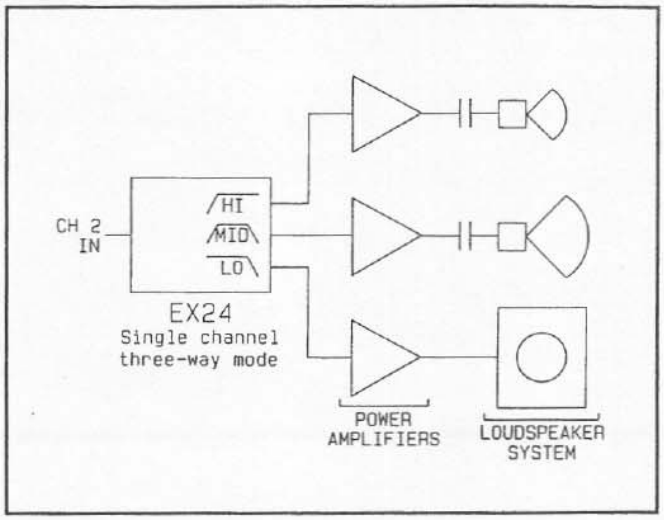



**Figure 6:** Typical Tri-Amplified Sound System

## 7 SPECIFICATIONS

| | |
|---|---|
| **Channel Configurations:** | Stereo two-way or monaural three-way. |
| **Filter Type:** | 4th-order Linkwitz-Riley. |
| **Filter Slope:** | 24 dB/octave. |
| **Crossover Frequencies:** | 80, 125, 160, 250, 500, 630, 800, 1.25k, 1.6k, 2.5k, 5k, and 6.3k Hz. |
| **Gain:** | Adjustable, off to +12 dB; center detent at unity gain. |
| **Frequency Response:** (sum of outputs) | 30 Hz to 20 kHz, ±3 dB. |
| **THD:** (20 Hz to 20 kHz) | <0.05% typical. |
| **IMD (SMPTE 4:1):** | <0.05% typical. |
| **Noise:** (Each output; 20 Hz to 20 kHz NBW) | -90 dBu typical. |
| **Crosstalk:** | -70 dB typical. |
| **Inputs:** | |
| Type: | Electronically differential balanced. |
| Maximum level: | +20 dBu (7.75 V rms). |
| Impedance: | 15 kohm unbalanced.<br>30 kohm balanced. |
| CMRR: | 40 dB minimum,<br>55 dB typical. |
| Connectors: | Female 3-pin XLR-type and ¼" phone. |
| **Outputs:** | |
| Type: | Electronically servo-balanced. |
| Maximum level: | +18 dBm. |
| Impedance: | 100 ohm unbalanced,<br>200 ohm balanced. |
| Min. load impedance: | 600 ohm. |
| Connectors: | Male 3-pin XLR-type and ¼" phone. |
| **Power Requirements:** | 100, 120, 220, 240 Vac, 50/60 Hz, 8 W. |
| **Fuse Type:** | Littlefuse Type 3AB 175 mA/250 V Slo-Blo® or equivalent. |
| **Dimensions:** | |
| Height: | 1.75 inches (4.4 cm). |
| Width: | 19.0 inches (48.3 cm). |
| Depth: | 5.88 inches (14.9 cm). |
| **Weight:** | |
| Shipping: | 7.0 lbs (3.2 kgs). |
| Net: | 5.4 lbs (2.5 kgs). |
| **Enclosure:** | Rack mount chassis, 18 GA steel. |
| **Color:** | Gray front panel, black chassis. |

EV/DYNACORD continually strives to improve products and performance. Therefore, the specifications are subject to change without notice.

Slo-Blo® is a registered trademark of Littlefuse, Inc.

EV DYNACORD®

## LIMITED WARRANTY STATEMENT

EV/DYNACORD products are guaranteed against malfunction due to defects in materials or workmanship for a specified period, as noted in the individual product-line statement(s) below, or in the individual product data sheet or owner's manual, beginning with the date of original purchase. If such malfunction occurs during the specified period, the product will be repaired or replaced (at our option) without charge. The product will be returned to the customer prepaid. **Exclusions and Limitations:** The Limited Warranty does not apply to: (a) exterior finish or appearance; (b) certain specific items described in the individual product-line statement(s) below, or in the individual product data sheet or owner's manual; (c) malfunction resulting from use or operation of the product other than as specified in the product data sheet or owner's manual; (d) malfunction resulting from misuse or abuse of the product; or (e) malfunction occurring at any time after repairs have been made to the product by anyone other than EV/DYNACORD or any of its authorized service representatives. **Obtaining Warranty Service:** To obtain warranty service, a customer must deliver the product, prepaid, to EV/DYNACORD or any of its authorized service representatives together with proof of purchase of the product in the form of a bill of sale or receipted invoice. A list of authorized service representatives is available from EV/DYNACORD at 600 Cecil Street, Buchanan, MI 49107 (616/695-6831 or 800/685-2606). **Incidental and Consequential Damages Excluded:** Product repair or replacement and return to the customer are the only remedies provided to the customer. EV/DYNACORD shall not be liable for any incidental or consequential damages including, without limitation, injury to persons or property or loss of use. Some states do not allow the exclusion or limitation of incidental or consequential damages so the above limitation or exclusion may not apply to you. Other Rights: This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

**EV/DYNACORD Electronics** are guaranteed against malfunction due to defects in materials or workmanship for a period of three (3) years from the date of original purchase. Additional details are included in the Uniform Limited Warranty statement.

# EX24 Active Crossover

# SERVICE INSTRUCTIONS

*** * * CAUTION * * ***

NO USER SERVICEABLE PARTS INSIDE. EXTREMELY HAZARDOUS VOLTAGES AND CURRENTS MAY BE ENCOUNTERED WITHIN THE CHASSIS. THE SERVICING INFORMATION CONTAINED WITHIN THIS DOCUMENT IS ONLY FOR USE BY EV/DYNACORD'S AUTHORIZED WARRANTY REPAIR STATIONS AND QUALIFIED SERVICE PERSONNEL. TO AVOID ELECTRIC SHOCK, DO NOT PERFORM ANY SERVICING OTHER THAN THAT CONTAINED IN THE OPERATING INSTRUCTIONS UNLESS YOU ARE QUALIFIED TO DO SO. OTHERWISE, REFER ALL SERVICING TO QUALIFIED SERVICE PERSONNEL.

## 8 SERVICE INFORMATION

**WARNING:** *No user serviceable parts inside. Extremely hazardous voltages and currents may be encountered within the chassis. The servicing information contained within this document is only for use by EV/DYNACORD authorized warranty repair stations and qualified service personnel. To avoid electric shock, DO NOT perform any servicing other than that contained in the Operating Instructions unless you are qualified to do so. Otherwise, refer all servicing to qualified service personnel.*

**NOTICE:** *Modification to EV/DYNACORD products is not recommended. Such modifications shall be at the sole expense of the person(s) or company responsible, and any damage resulting therefrom shall not be covered under warranty or otherwise.*

### 8.1 Electrical Configuration

#### 8.1.1 120 Vac, 50/60 Hz Configuration

The crossover is provided with the primary of the power transformer strapped for 120 Vac operation from the factory. Refer to Figure 8 for wiring details.

**WARNING:** *Verify that the power transformer's primary circuit configuration is correct for the intended ac line voltage **BEFORE** applying power to the crossover.*

#### 8.1.2 100, 220, 240 Vac, 50/60 Hz Configurations

The crossover may be powered from line voltages other than 120 volts by re-strapping the primary of the power transformer. Use the following procedures to change the factory strapping to the desired line voltage.

1. Disconnect the crossover from the ac power source.
2. Remove and save the seven screws securing the top cover. There are two screws on each side, two screws on the rear, and one screw inset into the front panel. Refer to Figure 7 for exact screw locations.

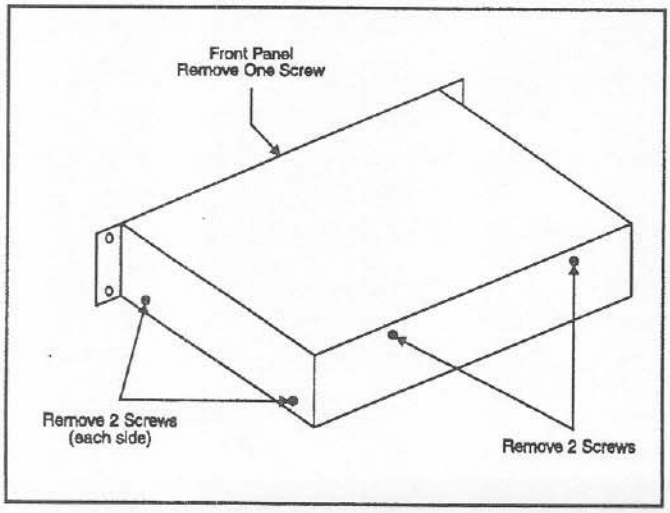



**Figure 7:** Top Cover Removal

3. Locate the eight voltage select solder cups near the power transformer. Referring to Figure 8, reconnect the leads corresponding to the desired primary voltage.
4. Install the top cover with the seven screws previously removed.
5. Install the proper fuse value from the table below:

| AC Line Voltage | AC Line Fuse |
|---|---|
| 100 V | 175 mA/250 V |
| 120 V | 175 mA/250 V |
| 220 V | 80 mA/250 V |
| 240 V | 80 mA/250 V |

### 8.2 Optional Fixed Frequency Modification

Provisions have been designed into the crossover that allow the user to bypass the front panel FREQUENCY controls and permanently set the crossover frequency to one fixed value. This may be used if one of the selectable frequencies will not suit a particular application or the user may simply wish to permanently set the unit to one of the frequencies already provided. In either case, the unit's crossover frequency will be fixed at one set value. This modification is performed by adding four resistors to each crossover circuit. The resistor locations are designated by R18, R19, R20, R21 in Channel 1 and R118, R119, R120, R121 in Channel 2. These resistor locations are shown in Figure 9.

**NOTE:** *By performing this modification the user forfeits the ability to use the modified channel's FREQUENCY control. Resistors R18 - R21 in Channel 1 and R118 - R121 in Channel 2 **MUST** be removed in order to return that channel to the FREQUENCY selectable state.*

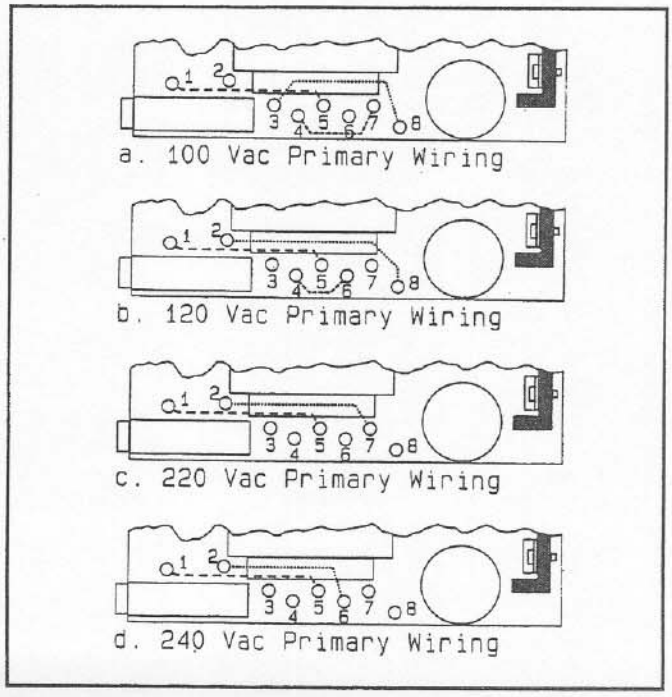



**Figure 8:** Primary Wiring Configurations

The front panel FREQUENCY control must be in the 80 Hz position and the selected fixed frequency must be greater than 80 Hz. If the desired crossover frequency is between 80 Hz and 800 Hz, ensure that the RANGE switch is *out* and use Equation 1 to obtain the resistor value. If the desired crossover frequency is greater than 800 Hz, ensure that the RANGE switch is *in* and use Equation 2.

(1) $R = (8 \times 10^6) / (f_c - 80)$
(2) $R = (8 \times 10^7) / (f_c - 800)$

where R = R18(R118) = R19(R119) = R20(R120) = R21(R121) in ohms and $f_c$ is the desired crossover frequency in hertz. Choose the nearest standard value.

**NOTE:** *Metal film 1% resistors are highly recommended for this modification.*

To implement this modification, follow this procedure:

1. Disconnect the crossover from ac power.
2. Remove and save the seven screws securing the top cover. There are two screws on each side, two screws on the rear, and one screw inset into the front panel.
3. Find the resistor locations R18 - R21 and/or R118 - R121. Refer to Figure 9.
4. At each location, solder the calculated valued resistor into the solder pads from the top side of the printed circuit board.
5. Verify that the FREQUENCY controls are in the 80 Hz position and that the RANGE switch is in the desired position.
6. Replace the top cover with the seven screws previously removed.

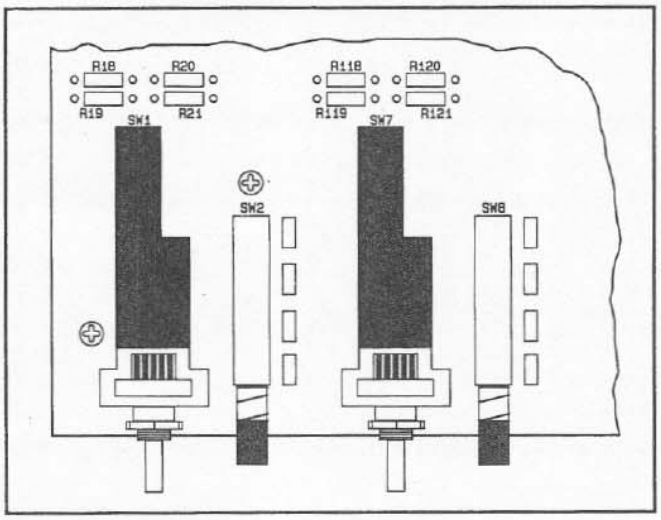



**Figure 9:** Location of Fixed Frequency Resistors

### 8.3 Ordering Replacement Parts

To order replacement parts, look up the ordering number from the component parts listing and call E.S.T. (616) 695-6831, FAX (800) 685-6386, or write:

EV/DYNACORD Service
600 Cecil Street
Buchanan, MI 49107 U.S.A.

### 8.4 Technical Assistance

For applications assistance or other technical information, contact the Applications Engineer. You can call (616) 695-6831, FAX (616) 695-1304, or write:

EV/DYNACORD
Applications Engineer
600 Cecil Street
Buchanan, MI 49107 U.S.A.

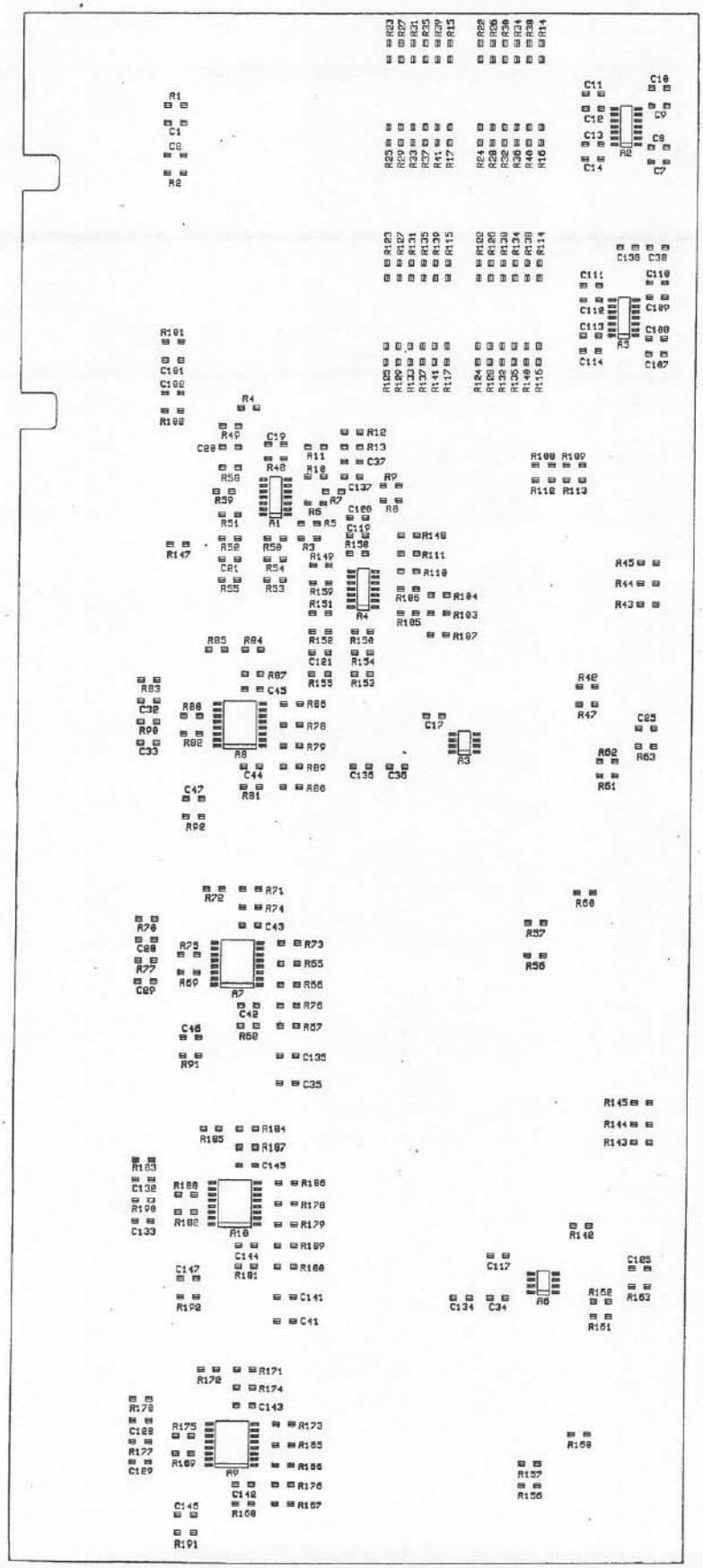


**Figure 10:** Component Layout of Underside of Main Board

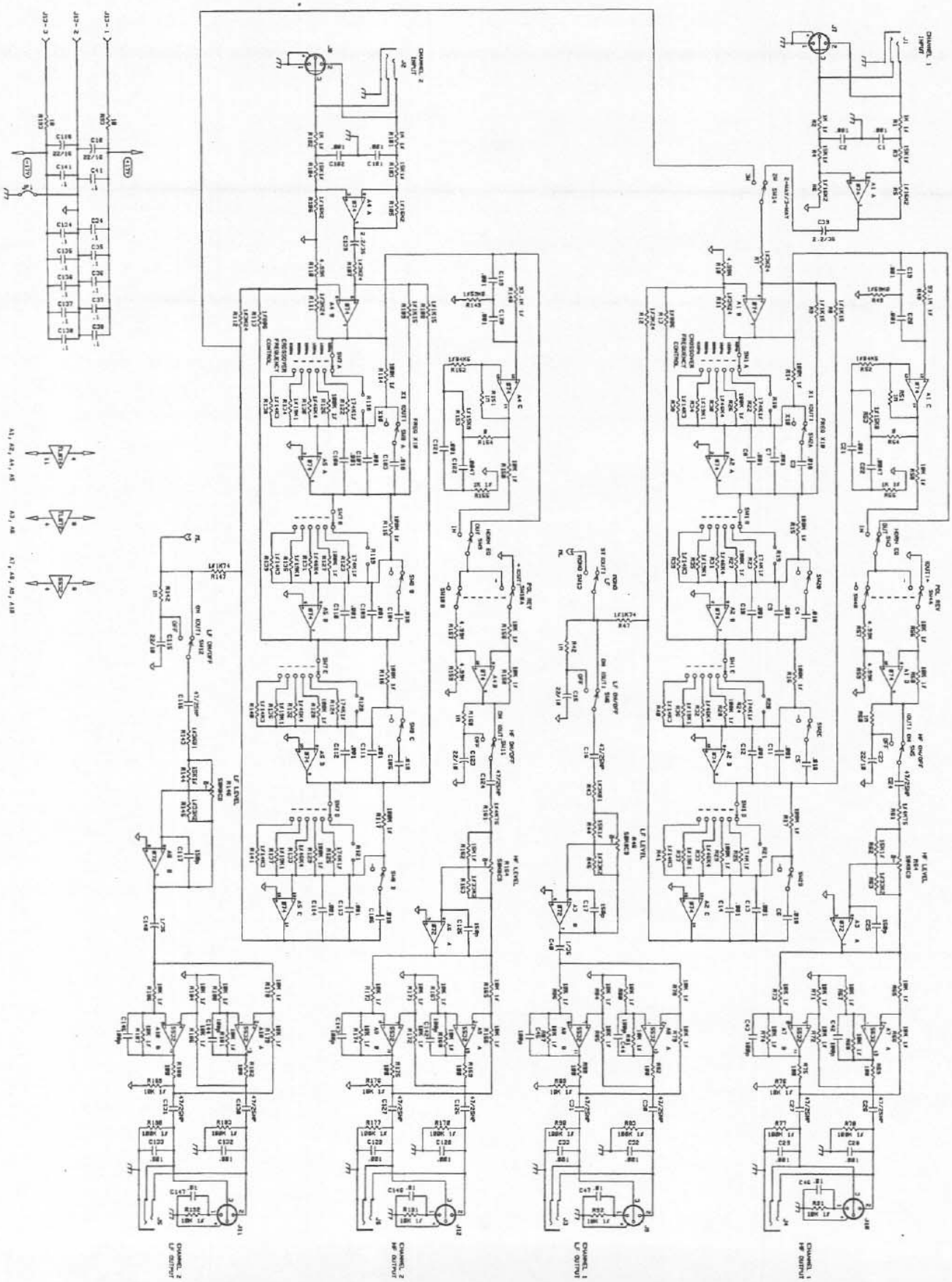


**Figure 11:** Schematic of the EX24 (11D768)

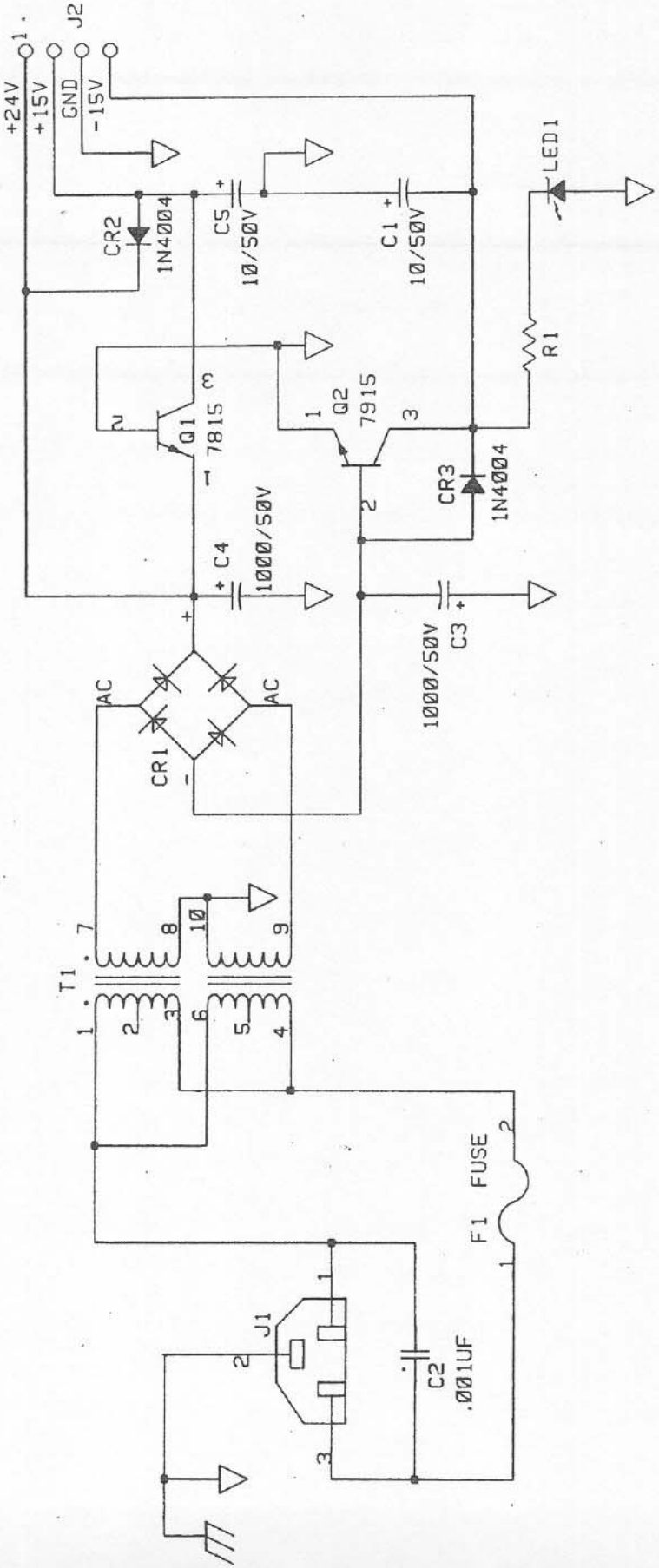



**Figure 12:** Schematic of the EX24 Power Supply (11B774)

# Component Parts List

## Main Board Assembly (27-01-036046)

| Reference Designator | Ordering Number | Name and Description |
|---|---|---|
| A1, A2, A4, A5 | 17-01-125143 | IC, TL074, smd |
| A3, A6 | 17-01-125141 | IC, TL072, smd |
| A7 thru A10 | 17-01-125142 | IC, NE5532, smd |
| C1,C2,C28,C29,C32,C33,C101, C102,C128,C129,C132,C133 | 15-02-125147 | Capacitor, .001 µF, 100 V, 10%, smd |
| C3 thru C6,C103 thru C106 | 15-06-028019 | Capacitor, .018 µF, 100 V, 10%, mylar |
| C7 thru C14, C19, C20, C21, C107 thru C114, C119, C120, C121 | 15-02-125148 | Capacitor, .001 µF, 50 V, 5%, smd |
| C15, C23, C115, C123 | 15-01-026793 | Capacitor, 22 µF, 10 V, electrolytic, radial |
| C16, C24, C26, C27, C30, C31, C116, C124, C126, C127, C130, C131 | 15-01-027327 | Capacitor, 47 µF, 25 V, 20%, electrolytic, radial |
| C17, C25, C117, C125 | 15-02-125146 | Capacitor, 150 pF, 100 V, 10%, smd |
| C18, C118 | 15-01-028154 | Capacitor, 22 µF, 16 V, electrolytic, radial |
| C22, C122 | 15-06-026824 | Capacitor, .0047 µF, 50 V, 5% |
| C34 thru C38, C41, C134 thru C138, C141 | 15-02-125144 | Capacitor, 0.1 µF, 50 V, 10%, smd |
| C39, C139 | 15-01-028851 | Capacitor, 2.2 µF, 35 V, electrolytic, radial |
| C40, C140 | 15-01-028850 | Capacitor, 1 µF, 35 V, electrolytic, radial |
| C42 thru C45,C142 thru C145 | 15-02-125149 | Capacitor, 100 pF, 50 V, 10%, smd |
| C46, C47, C146, C147 | 15-02-125145 | Capacitor, .01 µF, 100 V, 10%, smd |
| JP1 | 21-01-110310 | Resistor, 0 ohm jumper |
| R1, R2, R55, R101, R102, R155 | 47-03-125153 | Resistor, 1 kohm, 0.125 watt, 1%, smd |
| R3, R4, R44, R62, R103, R104, R144, R162 | 47-03-125155 | Resistor, 15 kohm, 0.125 watt, 1%, smd |
| R5, R6, R105, R106 | 47-03-125157 | Resistor, 16.2 kohm, 0.125 watt, 1%, smd |
| R7, R11, R12, R107, R111, R112 | 47-03-125161 | Resistor, 3.24 kohm, 0.125 watt, 1%, smd |
| R8, R9, R108, R109 | 47-03-125162 | Resistor, 1.15 kohm, 0.125 watt, 1%, smd |
| R10, R57, R59, R110, R157, R159 | 47-03-125160 | Resistor, 4.99 kohm, 0.125 watt, 1%, smd |
| R13, R113 | 47-03-125163 | Resistor, 806 ohm, 0.125 watt, 1%, smd |
| R14 thru R17, R26 thru R29, R70, R77, R83, R90, R114 thru R117, R126 thru R129, R170, R177, R183, R190 | 47-03-125152 | Resistor, 100 kohm, 0.125 watt, 1%, smd |
| R22 thru R25, R122 thru R125 | 47-03-125167 | Resistor, 174 kohm, 0.125 watt, 1%, smd |
| R30 thru R33, R130 thru R133 | 47-03-125173 | Resistor, 46.4 kohm, 0.125 watt, 1%, smd |
| R34 thru R37, R134 thru R137 | 47-03-125165 | Resistor, 19.1 kohm, 0.125 watt, 1%, smd |
| R38 thru R41, R138 thru R141 | 47-03-125159 | Resistor, 14.3 kohm, 0.125 watt, 1%, smd |
| R42, R51, R60, R142, R151, R160 | 47-01-125150 | Resistor, 1 Mohm, 0.125 watt, 5%, smd |
| R43, R143 | 47-03-125164 | Resistor, 3.01 kohm, 0.125 watt, 1%, smd |
| R45, R63, R145, R163 | 47-03-125169 | Resistor, 33.2 kohm, 0.125 watt, 1%, smd |
| R46, R64, R146, R164 | 47-06-027344 | Pot., 50 kohm, linear taper, center detent, 20% |
| R47, R147 | 47-03-125168 | Resistor, 1.74 kohm, 0.125 watt, 1%, smd |
| R48, R148 | 47-03-125156 | Resistor, 93.1 kohm, 0.125 watt, 1%, smd |
| R49, R149 | 47-03-125172 | Resistor, 59.0 kohm, 0.125 watt, 1%, smd |
| R50, R56, R58, R65 thru R68, R71 thru R74, R76, R78 thru R81, R84 thru R87, R89, R91, R92, R150, R156, R158, R165 thru R168, R171 thru R174, R176, R178 thru R181, R184 thru R187, R189, R191, R192 | 47-03-125154 | Resistor, 10 kohm, 0.125 watt, 1%, smd |
| R52, R152 | 47-03-125158 | Resistor, 84.5 kohm, 0.125 watt, 1%, smd |
| R53, R153 | 47-03-125170 | Resistor, 15.8 kohm, 0.125 watt, 1%, smd |
| R54, R154 | 47-01-125171 | Resistor, 0 ohm jumper, smd |
| R61, R161 | 47-03-125166 | Resistor, 4.75 kohm, 0.125 watt, 1%, smd |
| R69, R75, R82, R88, R169, R175, R182, R188 | 47-01-125151 | Resistor, 100 ohm, 0.125 watt, 5%, smd |
| R93, R193 | 47-01-102030 | Resistor, 10 ohm, 0.25 watt, 5% |
| SW1, SW7 | 51-01-027347 | Switch, rotary, 4P6T |
| SW2, SW8 | 51-02-028058 | Switch, push button, 4PDT |
| SW3 thru SW6, SW9 thru SW14 | 51-02-026810 | Switch, push button, DPDT |

| Reference Designator | Ordering Number | Name and Description |
|---|---|---|
| J1 thru 6 | 21-01-028714 | Connector, 1/4" phone. |
| J7, 8 | 21-01-124470 | Connector, XLR-female. |
| J9, 10, 11, 12 | 21-01-124642 | Connector, XLR-male. |

## Power Supply Board Assembly (27-01-036009)

| | | |
|---|---|---|
| C1, C2 | 15-01-124505 | Capacitor, 1000 µF, 50 V, electrolytic, radial |
| C3, C4 | 15-01-124502 | Capacitor, 10 µF, 50 V, electrolytic, radial |
| CR1 | 48-02-125062 | Bridge Rectifier, 1 A, pc mount |
| CR5, CR6 | 48-02-042787 | Diode, 1N4004, 400 V |
| F1 | 51-04-124634 | Fuse, 175 mA, 250 V, Slo-Blo® |
| R1 | 47-01-102080 | Resistor, 1.2 kohm, 0.25 watt, 5% |
| T1 | 56-08-025906 | Transformer, power |
| U1 | 17-01-121660 | IC, 7815, +15 V, regulator |
| U2 | 17-01-121659 | IC, 7915, -15 V, regulator |
| J1 | 21-02-124466 | Receptacle, AC. |

## Various Parts

| | |
|---|---|
| 60-06-124962 | Cable, power. |
| 24-04-029104 | Knob, lt. blue/gray. |
| 24-04-029107 | Knob, lt. gray/gray. |
| 24-04-036109 | Button, gray. |