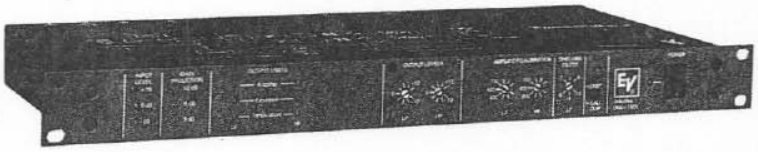
Electro-Voice®
THE DELTAMAX™ SYSTEM

OWNER'S MANUAL



DMC-1152X CONTROLLER
DMS-1152/64 LOUDSPEAKERS

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WARNING: TO REDUCE THE RISK OF FIRE OR ELECTRIC SHOCK, DO NOT EXPOSE THIS EQUIPMENT TO RAIN OR MOISTURE.

DESCRIPTION

GENERAL

The DeltaMax™ DMC-1152X/DMS-1152/64 systems consist of two-way biamped, high-performance speaker systems and companion electronic controllers. The DMS-1152/64 is a full-range loudspeaker system intended for high-level sound reinforcement in touring-sound and permanent-installation applications. The trapezoidal cabinet shape allows tight cluster designs, enabling maximum mutual coupling and single-point-source arrays. The unique circuitry of the DMC controller provides accurate protection for the loudspeakers without the use of shifting high-pass or low-pass filters, shifting crossover frequencies or independent band-pass compression. The electronic protection is invoked only when catastrophic conditions are present for the loudspeakers. The result is that accurate frequency response is maintained from the lowest sound pressure levels to the very highest sound pressure levels available from the loudspeakers.

There are two models in the DMS-1152/64 series: the DMS-1152/64AP (painted finish) and the DMS-1152/64APF (painted finish with flying hardware).

The DMS-1152X employs a 15-inch EVX155 for low-frequency reproduction, and a standard 1-inch-exit DH2T compression driver. The systems use flat-front, constant-directivity, high-frequency horns which are based on the Electro-Voice HP series (Patent #4,685,532) and are geometrically optimized for performance from 1,250- to 20,000-Hz.

The DeltaMax™ flying version model DMS-1152/64APF includes two lengths of aircraft-type L-track rigging hardware on the top and bottom of the enclosures to facilitate the hanging of multi-cabinet arrays. Each DeltaMax™ flying system is packed with a separate owner's manual which provides specific hanging instructions.

The electronic circuits are designed to provide optimum audio performance, even when the audio drive level is increased for maximum loudness. Precise speaker modeling circuits control a high-performance compressor and voltage limiter which provide speaker excursion protection, voice-coil temperature protection, and amplifier maximum-power limiting.

Where very high levels of deep bass are required, the DMC-2181X/DMS-2181 DeltaMax™ subwoofer system may be added to the DMC-1152X/ DMS-1152/64. The DMS-2181 loudspeaker cabinet, with two manifold eighteen-inch speakers, and the DMC-2181X series electronic controllers were designed specifically to work in conjunction with the two-way systems to provide extremely high-level low-frequency output down to 35 Hz.

Optimum performance of these speakers can only be assured when used with their dedicated electronics. Although maximum protection is not available, the DeltaMax™ systems are also effectively controlled by the Electro-Voice Dx34 digital crossover system.

FEATURE SUMMARY

- Fourth-order Linkwitz-Riley crossover filters provide smooth, accurate response through the crossover region.
- Special equalization circuits allow flat, wideband system response.
- Sensing circuits for the drivers control the compressor and voltage limiter to prevent voice-coil overheating, overexcursion and amplifier clipping without affecting spectral balance or program dynamics.
- Dual-time-constant compressor circuit with variable compression ratio reduces peak and average levels for loudspeaker thermal protection and amplifier clipping prevention as necessary while preserving relative program dynamics.
- Voltage-clamp loudspeaker excursion protection does not alter overall program dynamics or frequency response.
- A connection to the control voltage is available through a jack on the back panel. This allows precise gain tracking when more than one unit is used.
- The front panel display shows drive signal level and compressor gain reduction. Sensing display for each sense channel shows amplifier limit, excursion limit, and temperature limit. When its limit is approached, each LED lights yellow.
- Speaker system is trapezoidal for compact arrays. Flying versions feature integral, aluminum-reinforced fittings to facilitate hanging.
- Both the woofer and the compression driver employ the best available technology for high power and accurate sound reproduction.
- A state-of-the-art, flat-front, constant-directivity horn is utilized for even coverage and flat response.
- Low-frequency shelving filter to facilitate control of multi-enclosure arrays.

CONTROLLER SPECIFICATIONS

CHANNEL CONFIGURATIONS:
Monoaural two-way; two sense channels
FILTER TYPE:
4th-order Linkwitz-Riley
CROSSOVER FREQUENCY:
1,480 Hz
GAIN:
5 dB nominal
SIGNAL PATH EQUALIZATION (see Figure 1),
LF EQ:
–3 dB at 33 Hz, +10 dB at 55 Hz
LF Signal Delay:
0.49 ms at crossover frequency
HF EQ:
4th order optimized forDMS-1152/64 series HF driver and horn
TOTAL HARMONIC DISTORTION, 20 - 20,000 Hz:
0.03% typical, 0.1% maximum
NOISE, EACH OUTPUT, 20 - 20,000 Hz NBW, TYPICAL:
–86 dBu
SIGNAL INPUT,
Type:
Electronically balanced differential
Maximum Level:
+18 dBu
Impedance:
27,000 ohms and .0015mf
CMRR, Typical:
–55 dB
Connector:
Female 3-pin XLR-type
SENSE CHANNEL INPUTS,
Type:
Floating differential
Maximum Level,
LF: 145 V rms
HF: 145 V rms
Impedance:
100 kilohms each side to ground
Connector:
Two five-way binding posts
OUTPUTS (LF and HF):
Type:
Electronically balanced differential
Maximum Level:
+18 dBu
Minimum Load Impedance for Full Level:
600 ohms
Connectors:
Male 3-pin XLR-type
POWER REQUIREMENTS:
100, 120, 220, 240 V ac, 50 - 60 Hz, 13 W
CHASSIS CONSTRUCTION:
Painted steel
COLORS:
Gray front panel/black chassis with white graphics
MOUNTING:
EIA 19-inch rack mount, 1.75 in. high, 8.97 in. behind panel (including connectors); supplied with front-panel security cover for controls.

SYSTEM SPECIFICATIONS

Frequency Response (measured in far field, calculated to one meter on axis, swept sine wave, one watt into LF section 2.83 V at 250 Hz, anechoic environment; see Figure 1):
50-16,000 Hz

Crossover Frequency:
1,480 Hz

Efficiency, LF/HF:
4.2/25 %

Maximum Long-Term-Average Power-Handling Capacity (per EIA RS-426-A 1980), LF/HF:
600/60 watts

Maximum Long-Term-Average Midband Acoustic Output, LF/HF:
25/15 acoustic watts

Sensitivity (SPL at one meter, indicated input power, anechoic environment, average level), LF/HF,
1/1 watt: 98.0/113.0 dB
300/60 watts: 125.5/131.0 dB

Beamwidth (angle included by 6-dB-down points on polar responses, indicated one-third-octave bands of pink noise; see Figures 3 and 4),
Horizontal, 1,200-16,000 Hz:
60° (+40°, –5°)
Vertical, 1,200-16,000 Hz:
40° (+28°, –15°)

Directivity Factor, $R_\theta(Q)$, 1,200-16,000 Hz Average (see Figure 5):
19.7 (+7.2, –6.8)

Directivity Index, D_i, 1,200-16,000 Hz Average (see Figure 5):
13.0 dB (+1.4 dB, –1.8 dB)

Distortion (115 dB SPL at one meter, shaped spectrum; see Figure 6),
Second Harmonic,
100 Hz: 1.6%
500 Hz: 0.9%
2,000 Hz: 1.3%
5,000 Hz: 1.0%

SPEAKER SPECIFICATIONS

Third Harmonic,

100 Hz: 0.3%

500 Hz: 1.0%

2,000 Hz: <0.1%

5,000 Hz: <0.1%

Transducer Complement,

HF: DH2T driver, HP 64M 60° x 40° horn

LF: EVX-155 15-in. woofer

Impedance (see Figure 7),

Nominal, LF/HF: 8/8 ohms

Minimum, LF/HF: 7.4/6.9 ohms

Input Connections:

Two Neutrik NL4MPR Speakon® connectors paralleled

Recommended Amplifier Power,

HF: 125-250 watts

LF: 600-1,200 watts

Enclosure Construction,

Enclosure Shell:

18 mm, 13-ply birch plywood

Finish:

Black textured paint

Grille:

Vinyl-coated steel with foam

Rigging (DMS-1152/64PF only):

Two-point heavy-duty L-track system, accepts New Haven NH32102-2 double-stud fittings, or New Haven NH8192-2S or Ancra 42546-10 single-stud fittings with safety pins

Dimensions,

Height:

759 mm (29.88 in.)

Width (front):

450 mm (17.73 in.)

Width (back):

248 mm (9.75 in.)

Depth:

413 mm (16.28 in.)

Angle:

30° wedge

Net Weight:

35.4 kg (78 lb)

Shipping Weight:

37.6 kg (83 lb)

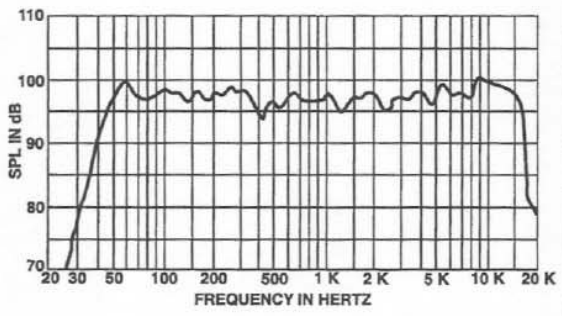


FIGURE 1—DMC-1152X/DMS-1152/64 Axial Frequency Response (1 watt/1 meter into LF mid band)

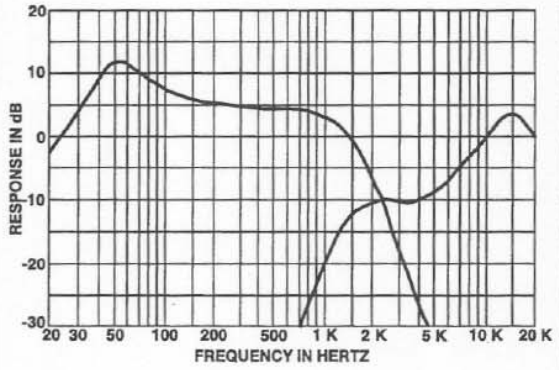
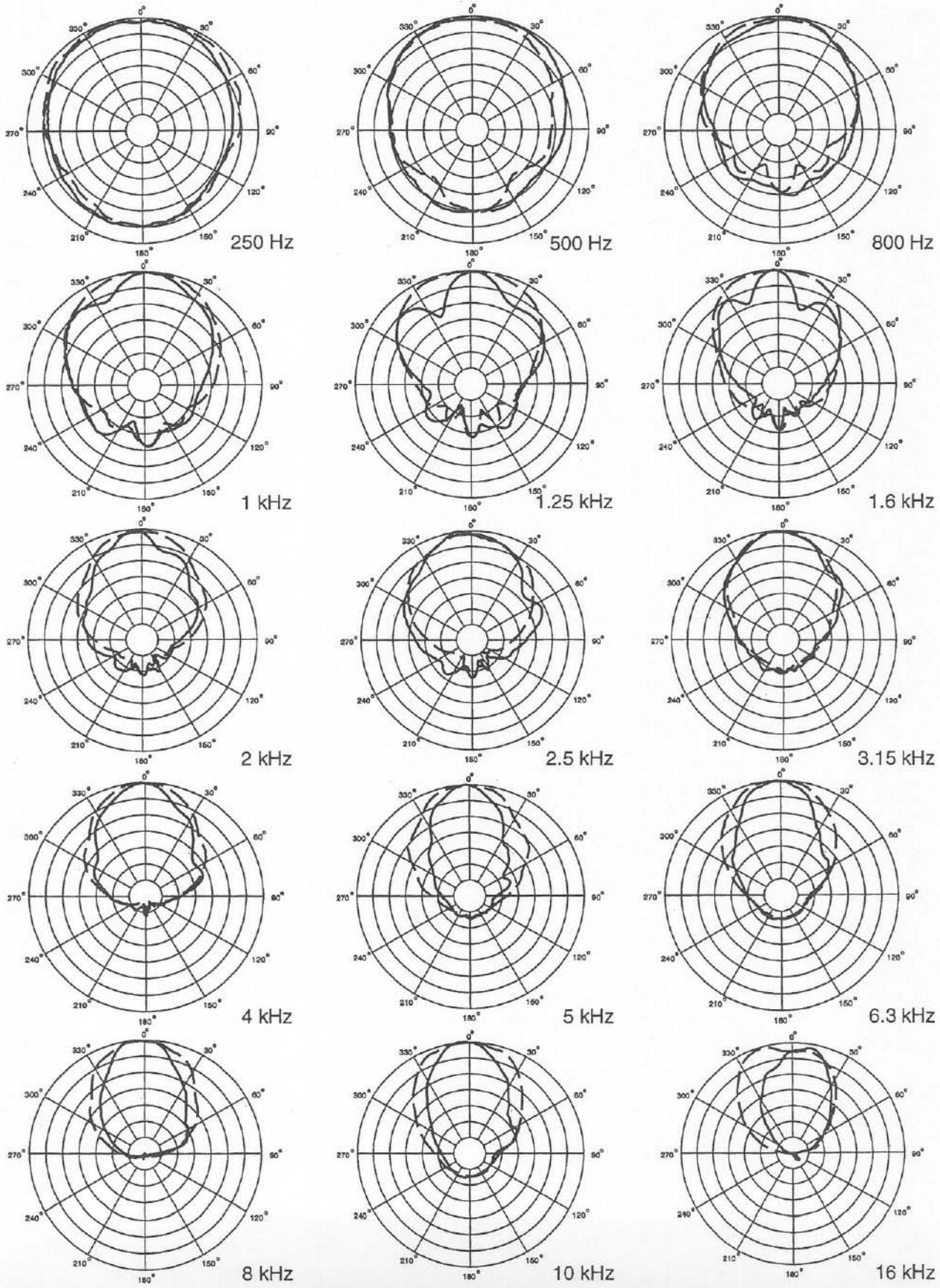


FIGURE 2—DMC-1152X Frequency Response

FIGURE 3—DMC-1152X/DMS-1152/64 Polar Response
(1/3-octave pink noise, 4 volts at 20 feet)



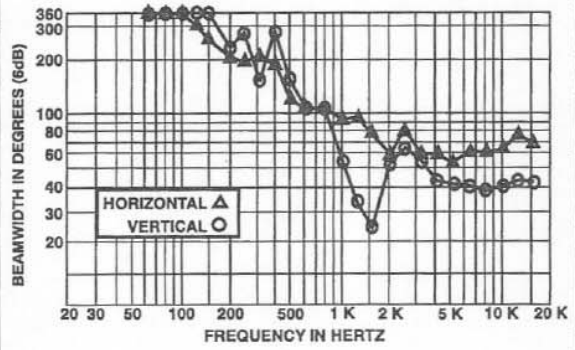


FIGURE 4—DMC-1152X/DMS-1152/64
Beamwidth vs. Frequency Whole Space
(anechoic)

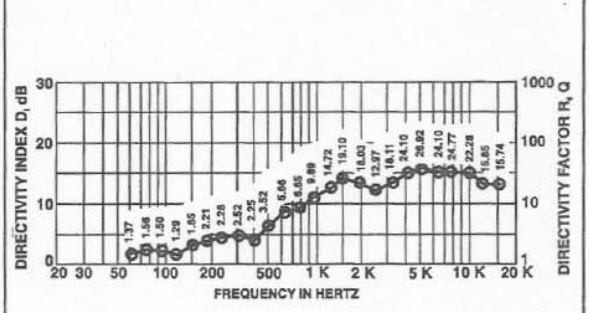


FIGURE 5—DMC-1152X/DMS-1152/64
Directivity Factor and Directivity Index
vs. Frequency Whole Space (anechoic)

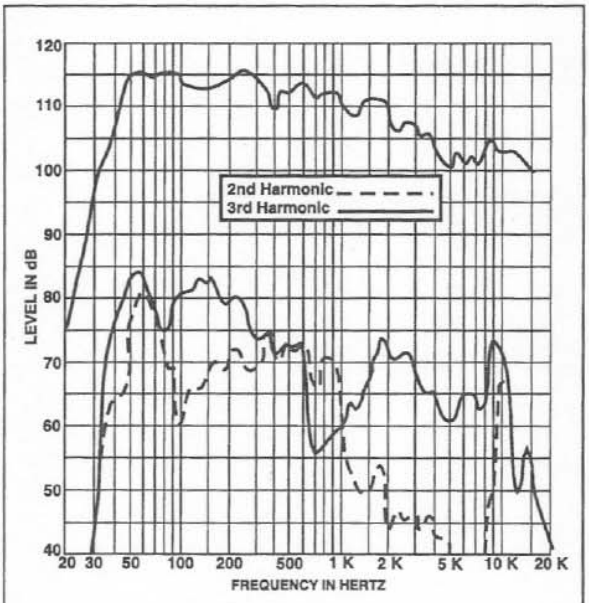


FIGURE 6—DMC-1152X/DMS-1152/64
Harmonic Distortion
(115 dB SPL/1 meter using typical
music frequency spectrum)

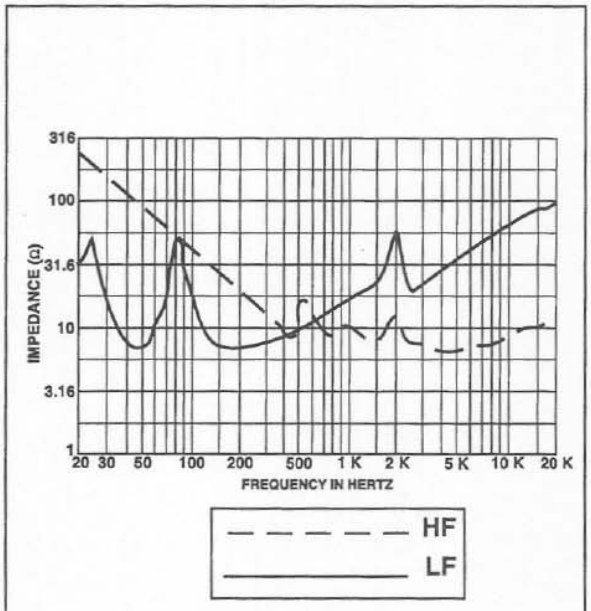
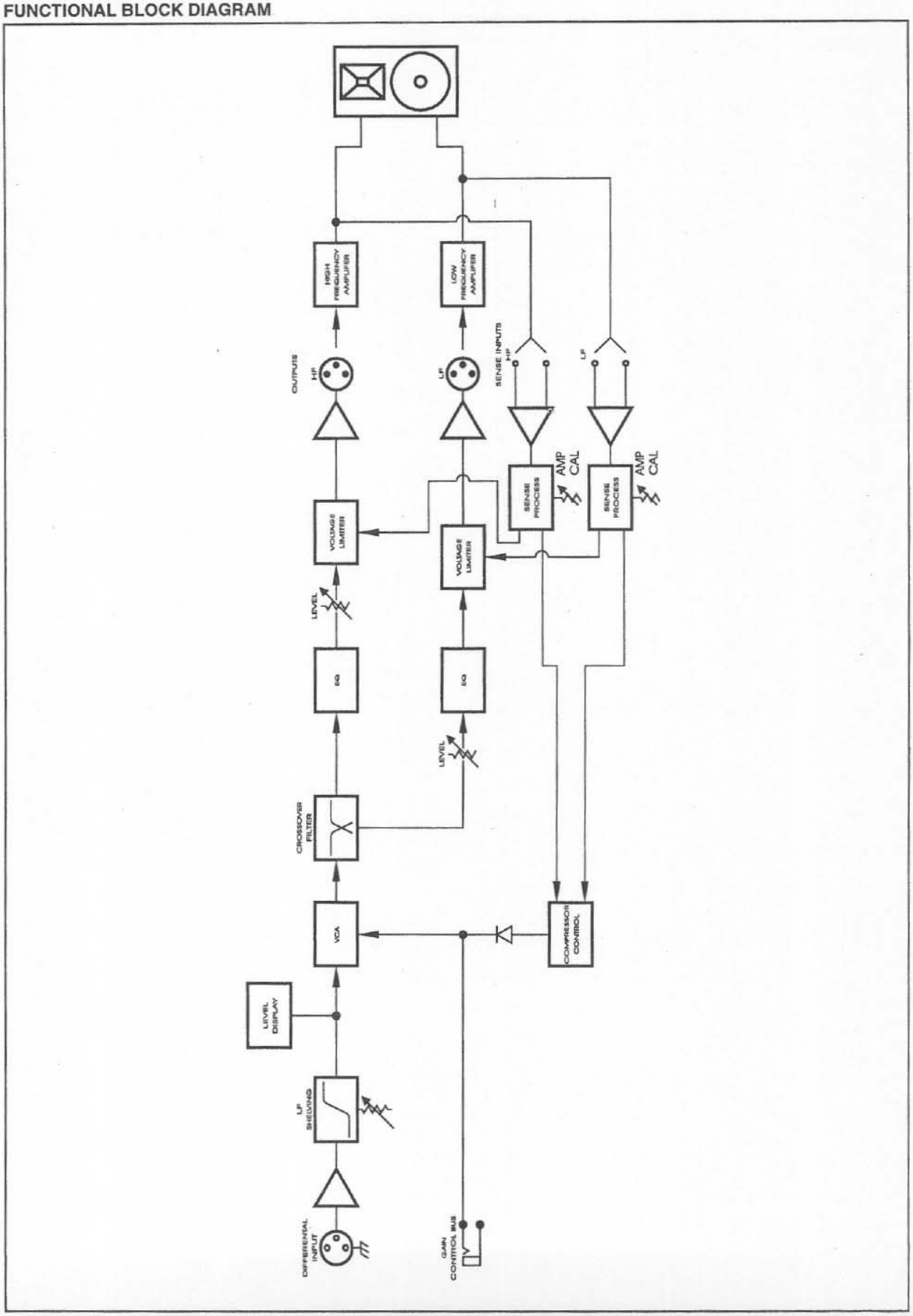
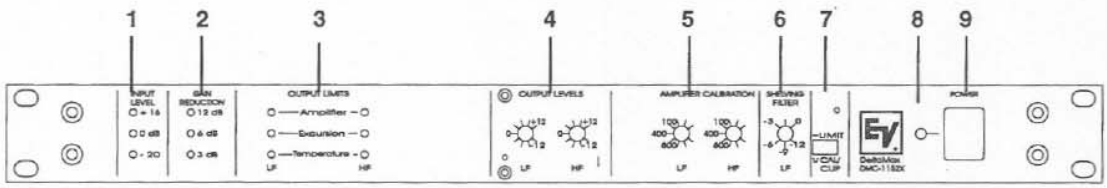


FIGURE 7—DMS-1152/64
Impedance
The impedance of each frequency band of the system was measured in an anechoic environment.

FUNCTIONAL BLOCK DIAGRAM





PICTORIAL 1—DMC-1152X Front Panel Diagram

OPERATION

FRONT PANEL INDICATORS AND CONTROLS

(refer to pictorial 1)

1. **INPUT LEVEL INDICATORS:** Three LEDs show the drive level at the input of the controller. Levels are calibrated in dBu (–20, 0, +16)

   NOTE: Do not allow the 16-dB input-level indicator to stay on continuously. If the 16-dB indicator is allowed to stay on for long periods, the input circuit will clip. The input signal should be reduced until the 16-dB indicator lights only on loud instantaneous peaks.

2. **GAIN REDUCTION INDICATORS:** Three LEDs show how much gain reduction is occurring in the compressor at the input of the controller. The display is calibrated in relative dB (3, 6, 12). Gain reduction occurs only when the maximum temperature, excursion and amplifier capabilities are exceeded for either the woofer or compression driver. The Output-Limits display indicates which limits are being exceeded when gain reduction occurs.

   NOTE: Do not allow the 12-dB-gain-reduction indicator to stay on continuously. If the 12-dB indicator is allowed to stay on for long periods, the speaker may be damaged. The input signal should be reduced until the 12-dB indicator lights only on loud passages.

3. **OUTPUT LIMIT INDICATORS:**

   A. **TEMPERATURE LIMIT:** These LED's light when the temperatures of the woofer or compression-driver voice coils approach their maximum allowable limit. Under this condition, gain reduction will occur at the input of the controller so that the maximum-temperature limits will not be exceeded for either the woofer or compression driver.

   B. **EXCURSION LIMIT:** These LED's light when the excursion of the woofer cone or compression-driver diaphragm approach their maximum allowable limit. Under this condition, voltage clamping will occur at the output of either the low- or high-frequency section so that the maximum-excursion limits will not be exceeded for either the woofer or compression driver.

   C. **AMPLIFIER LIMIT:** These LED's will provide status information for the high- and low-frequency power amplifiers if the controller has been calibrated to the amplifiers. (See the AMPLIFIER/ CONTROLLER CALIBRATION section.) With the Cal/Clip-Limit switch pressed in, the LED's will signal the occurrence of amplifier clipping. With the switch in the outward position, the LED's indicate that gain reduction in the form of hard limiting is occurring at the input of the controller to prevent the amplifiers from clipping.

4. **OUTPUT LEVEL CONTROLS:**

   A. **LF:** This control adjusts the level of the low-frequency output signal. The control range is from –12 to +12 dB.

   B. **HF:** This control adjusts the high frequency output signal. The control range is from –12 to +12 dB.

NOTE: The gain has been structured within the DMC-1152X controller so that DMS-1152/64 loudspeaker will have a flat frequency response (as shown in Figure 1) in an anechoic environment with the output levels of the controllers set in the 0-dB-detent position and with the amplifier channels having identical gain driving the LF and HF sections of the speakers.

OPERATION (continued)

5. **AMPLIFIER CALIBRATION CONTROLS:** These controls are used for calibrating the controller to both the low- and high-frequency amplifiers so that the controller can monitor the clipping of the amplifier outputs and, if desired, act as a limiter to prevent amplifier clipping. See AMPLIFIER/CONTROLLER CALIBRATION section.

   NOTE: The calibrated markings on the front panel correspond to the power level that an amplifier would deliver to an 8-ohm load. A crude, approximate calibration can be obtained by rotating the control until the slot of the trimpot points at a power level equivalent to the amplifier power rating for an 8-ohm load. (When the trimpot is in its mid position it is pointing at 400 watts.)

6. **LF SHELVING FILTER:** This control is used when multiple DMS-1152/64 systems are arrayed and low-frequency mutual coupling produces unbalanced spectral content. The control will attenuate low-frequency energy. The control range is from 0 to –12 dB.

7. **CAL-CLIP LIMIT SWITCH:** This switch selects the mode that controller will monitor the amplifiers (assuming that the controller has been calibrated to the amplifiers - see AMPLIFIER/CONTROLLER CALIBRATION section). With the switch pushed in, the Amplifier Limit LED's will indicate when the amplifiers are clipping. With the switch in the outward position, the Amplifier Limit LED's will indicate that gain reduction is occurring to prevent the amplifiers from clipping.

   NOTE: If the controller has not been calibrated to both the low- and high-frequency amplifiers, the Cal/Clip Limit switch should be pushed in. This will defeat the compressor/limiter from trying to prevent amplifier clipping. (The Amplifier Limit LED's will still flash when the amplifier exceeds the power levels that the Amplifier Calibration trimpots are set to.) Poor sound quality can result with incorrect calibration and the compressor/limiter engaged.

8. **POWER INDICATOR:** This LED lights when the controller is on.

9. **POWER SWITCH:** This switch turns the controller on and off.

BACK PANEL CONNECTIONS (refer to Pictorial 2)

1. **AC POWER CORD RECEPTACLE:** This receptacle is for the ac power cord (supplied with the unit).

2. **FUSE RECEPTACLE:** This fuse receptacle requires either a 0.25 A 250 V slow blow fuse (for 100/120 V ac operation), or a 0.1 A 250 V slow blow fuse (for 220/240 V ac operation).

3. **SENSE INPUTS:**

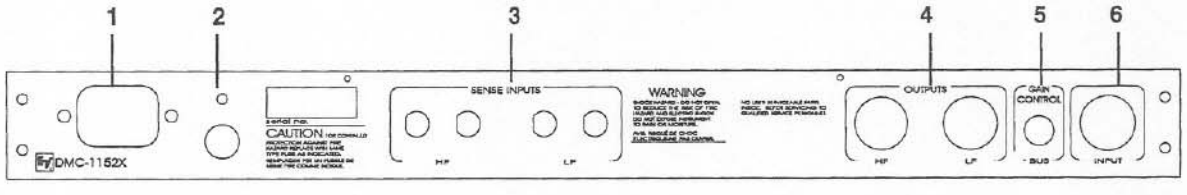
   A. **LF:** This input is for the connection of the sense line to monitor the power delivered to the woofer and should be connected to the output of the low-frequency amplifier.

   B. **HF:** This input is for the connection of the sense line to monitor the power delivered to the compression driver and should be connected to the output of the high-frequency amplifier.

   NOTE: The Sense Inputs are floating differential with 5-way binding posts, see CONNECTOR and CABLE REQUIREMENTS section for detailed wiring information.

4. **OUTPUTS:**

   A. **LF:** This input is the low-frequency output of the DMC crossover/controller and should be connected to the input of the low-frequency amplifier.



PICTORIAL 2—DMC-1152X Back Panel Diagram

OPERATION (continued)

B. **HF:** This connection is the high-frequency output of the DMC crossover/controller and should be connected to the input of the high-frequency amplifier.

5. **GAIN CONTROL BUS:** This 1/4-inch jack is for slaving the gain-control busses of other DMC controllers to enable gain tracking in a multiple-controller system. See CONNECTOR and CABLE REQUIREMENTS section for detailed wiring information.
6. **INPUT:** This connection is for the full-range signal input to the DMC controller. This input is electronically balanced with a female 3-pin XLR-type connector with pin 1 as a ground reference, pin 2 high (+) and pin 3 low (–). See CONNECTOR and CABLE REQUIREMENTS section for detailed wiring information.

TYPICAL SYSTEM OPERATION

The DMS-1152/64 is a full-range biamped loudspeaker system to be used with the DMC-1152X electronic controller. Besides conventional frequency division, the DMC electronic controllers have equalization and time delay to obtain optimum performance from their respective DeltaMax™ DMS loudspeaker systems. In addition, sense lines to the controllers monitor the voltage drive to each loudspeaker in the system and automatically activate protection circuitry to prevent cone/diaphragm over-excursion, voice-coil overheating and amplifier clipping. Before operating a DeltaMax™ system, the user should read this manual thoroughly and make sure that the system has been set up as detailed in the INSTALLATION section and the amplifiers and controller have been calibrated as detailed in the AMPLIFIER/CONTROLLER CALIBRATION section.

The gain and equalization structures in the DMC controllers have been set up so that the DMS loudspeaker systems will have a flat frequency response (in an anechoic environment) when the Output Level trimpots on the controllers are set in the 0-dB detent position and the amplifiers all have the same gain (i.e., the amplifiers are calibrated for 32 dB of gain as detailed in the AMPLIFIER/CONTROLLER CALIBRATION section). This gives the user a standard reference every time the system is set up. Adjustments to the drive levels of the low- and high-frequency sections are then only needed to compensate for room acoustics or array configurations. When adjustments are required, they should be made with the Output Level trimpots on the controllers. The level controls on the amplifiers should be left in their calibrated positions. (See the MULTIPLE LOUDSPEAKER ARRAY section for circumstances when it is permissible to adjust the amplifier level controls.)

The input circuit of the DMC controllers clips with a +18 dBu (6.2 volts rms) input signal. The input-signal level display has three LED's calibrated to –20, 0 and +16 dBu. To avoid clipping, the input should be driven only to the point that the +16 dB LED lights on instantaneous peaks. If more gain is desired from the controller, the Output Level trimpots may be turned up. Note that there are calibrated markings on the front panel of the controller (3 dB per division) to enable accurate gain adjustments.

Extensive modeling circuits allow the controller to monitor the status of the voice-coil temperature and the cone/diaphragm excursion of the loudspeakers in each frequency band. If a loudspeaker in one of the frequency bands approaches its maximum thermal limit, a multi-time-constant compressor circuit with a variable compression ratio will reduce the peak and average levels of the full-range input signal as necessary to protect the driver, while preserving the spectral balance and the relative program dynamics. When gain reduction occurs, an Output Limit Temperature LED will light indicating which frequency-band loudspeaker is reaching its thermal limit. If a loudspeaker in one of the frequency bands approaches its maximum excursion limit, a dynamic frequency-sensitive voltage-clamping circuit at the output of that frequency band will clamp the peak of the output waveform at a level above which excursion damage would occur to the loudspeaker; hence, preserving the overall spectral balance. When voltage clamping occurs, an Output Limit Excursion LED will light indicating which frequency-band loudspeaker is reaching its excursion limit.

The DMC Controller will also prevent long-term amplifier clipping. The controller must be calibrated as detailed in the AMPLIFIER/CONTROLLER CALIBRATION section and the Cal/Clip Limit switch must be in the Out position for this function to work properly. If an amplifier in one of the frequency bands approaches clipping, a multi-time-constant compressor-limiter circuit will reduce the peak and average levels of the full-range input signal as necessary to prevent long-term clipping while preserving the overall spectral balance. When gain reduction occurs, an Output Limit Amplifier LED will light indicating which frequency-band amplifier is reaching its power limit. With the Cal/Clip Limit switch pushed in, gain reduction will not occur to prevent amplifier clipping and the Output Limit Amplifier LED's will simply indicate when the amplifiers are going into clipping.

The DeltaMax™ DMC controllers provide protection for the loudspeakers without affecting the overall spectral balance or dynamic range. The controllers have an LED display to inform the user when the protection circuitry is activated and what is causing the protection to take place. Each frequency band

OPERATION (continued)

has three LED's to indicate loudspeaker thermal-protection activation, loudspeaker excursion protection activation and amplifier clipping (or amplifier clipping prevention). In addition, there is an LED display to indicate the amount of long-term overall gain reduction occurring due to loudspeaker thermal protection and amplifier clipping prevention. (The instantaneous loudspeaker excursion voltage-clamping protection is not reflected in the overall gain-reduction display.)

In very high-powered applications, the detailed displays on the DMC controllers provide the user with information to make adjustments or changes to the system (if desired) to eliminate the protection and increase the acoustic output. For example:

- If an excessive amount of low-frequency excursion protection is occurring, selective equalization can be used (1/3-octave-band equalizer, parametric equalizer, etc.) to reduce the level in the frequency range that is causing the excessive excursion, allowing the overall level to be turned up. If the desired amount of high-level low-frequency response still cannot be obtained, subwoofers (or additional subwoofers) should be added to the system.
- If an excessive amount of loudspeaker thermal protection is occurring in any frequency band, more speaker systems are generally needed. If the program material has a lot of energy concentrated in a relatively small frequency range, selective equalization may serve as an effective compromise.
- If excessive amplifier clipping (or amplifier clipping prevention) is occurring without excessive loudspeaker thermal protection or excursion protection, larger power amplifiers should be used.
- If excessive loudspeaker thermal protection and excursion protection is occurring, more speakers should be used.
- If excessive overall gain reduction is occurring, more speakers should be added.
- If the 12-dB-gain-reduction LED is on for any significant portion of time, the level should be turned down. Levels driven beyond this point may exceed the protection capability of the protection circuitry.

When multiple controllers are used (such as in a stereo system) the control voltages should be slaved together as detailed in the INSTALLATION section. The gain of all of the controllers will then track whenever gain reduction occurs due to loudspeaker thermal protection or amplifier clipping prevention, regardless of which loudspeaker or amplifier was exceeding its limit. This will prevent acoustic image shifting at very high levels. When a DMC-2181X/DMS-2181 subwoofer system is used with a full-range DeltaMax™ system (such as a DMC-1152X/DMS-1152/64) the control voltages should be slaved together to prevent spectral balance shifting at high levels when gain reduction occurs for loudspeaker thermal protection or amplifier clipping prevention. The loudspeaker excursion voltage-clamping protection will still operate independently in each frequency band in each controller when the control voltages are slaved.

AMPLIFIER/CONTROLLER CALIBRATION

AMPLIFIER CALIBRATION PROCEDURE

Maximum performance of the DeltaMax™ controller protection circuitry occurs, under the most severely over-driven conditions, when the voltage gain of the amplifiers fall in the range of 27 to 35 dB (with 32 dB being optimum). This gain range is typical of most high-power amplifiers and can easily be adjusted by simply adjusting the level controls on the amplifier.

The procedure for calibrating an amplifier to have 32 dB of gain is as follows:

1. With the amplifier turned on and without speakers hooked on the amplifier output, apply 0.5-volt rms 1,000-Hz sine-wave signal to the input of the amplifier.
2. Adjust the amplifier level control until the output of the amplifier measures 20 volts rms.

   NOTE: If the amplifier will be operated in the mono-bridged mode, it should be calibrated when wired in the mono-bridged configuration.

CONTROLLER CALIBRATION PROCEDURE

This procedure is for calibration of the DMC controller's internal amplifier limit circuits to the actual clip level of the power amplifiers. Calibration is set by the LF and HF Amplifier Calibration trimpots on the front panel.

Before plugging in the ac power cord, be sure the controller is wired for the correct primary (mains) voltage.

Disconnect the speakers and remove the security cover from the controller by removing the two screws on the front panel of the controller. Perform the following procedure:

1. Connect the controller to the low- and high-frequency power amplifier channels as detailed in the INSTALLATION section.
2. Be sure the controller LF and HF Sense Inputs are connected to the correct amplifier outputs and the **speakers are disconnected** from the amplifier.

AMPLIFIER/CONTROLLER CALIBRATION (continued)

3. Set the low- and high-frequency amplifier gain controls for 32 dB voltage gain, or as close as possible to 32 dB (this is optimum, but it can be in the range of 27 to 35 dB). See the AMPLIFIER CALIBRATION PROCEDURE section.
4. Turn the LF and HF Amplifier Calibration trimpots on the controller to full counterclockwise. Press the Cal/Clip Limit switch to its recessed Cal/Clip position with a screwdriver or other suitable tool.
5. In order to prevent thermal limiting from occurring while calibrating the amplifier limit levels, insert a shorted 1/4-inch phone plug (tip-sleeve) into the Gain control bus jack on the back of the controller. The Thermal Limit LED may still come on but no gain reduction should be indicated.
6. Send a 500-Hz sine-wave test signal to the controller input.
7. Adjust the signal source level until the low-frequency amplifier begins to clip (you may turn up the LF Output Level on the controller if necessary to get the amplifier to clip). Clipping is noted by the clip indicator on the power amplifier or by monitoring the output with an oscilloscope. Now, turn the level down until the clip light just goes out (or until the clipping disappears on the oscilloscope).
8. Turn the LF Amplifier Calibration trimpot on the controller clockwise with a screwdriver until the LF Amplifier Output Limit LED comes on. Note that the slot of the trimpot is pointed at the approximate power rating of the amplifier for an 8-ohm load as denoted by the calibrated markings on the front panel of the controller. Note also that this is the maximum amount of power capable of being delivered to a single driver in this amplifier configuration.

   The LF section of the controller is now calibrated. The LF Output Level trimpot may be adjusted as necessary for the desired frequency spectrum balance without affecting calibration.
9. Change the input test signal to a frequency of 5,000 Hz.
10. Adjust the signal source level until the high-frequency amplifier begins to clip (you may turn up the HF Output Level on the controller if necessary to get the amplifier to clip). Now, turn the level down until the clip light just goes out (or until the clipping disappears on the oscilloscope).
11. Turn the HF Amplifier Calibration trimpot on the controller clockwise with a screwdriver until the HF Amplifier Output Limit LED comes on. Note that the slot of the trimpot is pointed at the approximate power rating of the amplifier for an 8-ohm load as denoted by the calibrated markings on the front panel of the controller. Note also that this is the maximum amount of power capable of being delivered to a single driver in this amplifier configuration. If the power rating of the high-frequency power amplifier is much greater than 250 watts (and, hence, the HF Amplifier Calibration trimpot on the controller is set much greater than 250 watts), then an additional margin of safety for the high-frequency driver can be obtained by setting the HF Amplifier Calibration trimpot to 250 watts.

    The HF section of the controller is now calibrated. The HF Output Level trimpot may be adjusted as necessary for the desired frequency spectrum balance without affecting calibration.
12. **Remove the shorted 1/4-inch phone plug from the Gain Control Bus jack** and set the Cal/Clip Limit switch to the Limit position (out). Set the HF and LF Output Level controls to their center-detent position (or as desired).
13. Turn the amplifier off and connect the speaker cables to the output of the amplifier. Make certain that the "lows" are wired to the woofer and that the "highs" are wired to the compression driver. In addition, be sure to observe polarity when making speaker connections.

    NOTES:

    A. The Amplifier Calibration trimpots may be adjusted during use with program material to set the desired amount of amplifier limiting. The limiter in the controller will allow some fast transient peaks through, allowing some amplifier clipping to occur on signal peaks after the calibration procedure. The limiter circuit will, however, prevent long-term amplifier clipping when adjusted properly.

    B. The Cal/Clip Limit switch may be left in the recessed Cal/Clip position (in) if the power amplifier has an internal limiter, or if clip protection is not desired., When left in the Cal/Clip position, the Amplifier Output Limiter indicators on the front panel of the controller will indicate when the amplifier is self-limiting or clipping.

    C. If two or more speakers are connected in parallel to an amplifier output, most amplifiers will exhibit a drop in clipping voltage due to the lower load impedance. This will require that the Amplifier Calibration trimpot be set to a value slightly lower than the value obtained in the "no-load" calibration test.

AMPLIFIER/CONTROLLER CALIBRATION (continued)

Note that the result of this is that, even when multiple speakers are paralleled on an amplifier channel, the Amplifier Calibration trimpot will always end up pointing at the maximum amount of power (on the calibrated markings on the front panel) that the amplifier is capable of delivering to each individual driver no matter how many drivers are connected in parallel.

D. Do not change the amplifier gain, or recalibration will be necessary. Use the LF and HF Output Level controls on the controller to change power amplifier drive levels. The Output Level controls do not affect controller calibration

INSTALLATION

AMPLIFIER REQUIREMENTS

Professional power amplifiers with the following ratings are recommended for use with the DMC-1152X/DMS-1152/64 system:

LF: 600-1,200 watts continuous into eight ohms
HF: 125-250 watts continuous into eight ohms

The use of amplifiers with lower power ratings is acceptable, however, the full-power capabilities of the system will not be realized. The use of amplifiers with significantly higher power ratings is wasteful and may endanger the loudspeakers; it is generally not recommended.

Under certain circumstances, however, higher rated power amplifiers are acceptable. It is acceptable to drive the DMS-1152/64 speaker with a stereo power amplifier having the recommended LF power rating, utilizing one channel to drive the low frequencies and the other channel to drive the high frequencies. For an extra degree of protection when operating in this configuration, the user may want to set the HF Amplifier Calibration level to the 250-watt position to limit excessively high power levels from reaching the compression driver.

DMS-1152/64 speakers may be paralleled with other DMS-1152/64 speakers if the amplifier is capable of delivering adequate power to each speaker at the lower impedance. Under no circumstances should DMS-1122/85 and DMS-1152/64 speakers be paralleled on the same amplifier channels.

NOTE: For proper operation of the protection circuitry, the power amplifiers must be calibrated to have a voltage gain between 27 and 35 dB (32 dB is optimum). See the AMPLIFIER/CONTROLLER CALIBRATION section.

CONNECTOR AND CABLE REQUIREMENTS

Controller Connections

The DeltaMax™ controllers have 3-pin XLR-type connectors for signal input and output. The input is electronically balanced and has a female connector with pin 1 as a referenced ground, pin 2 high (+) and pin 3 low (–). The outputs are electronically balanced and have male connectors with pin assignments identical to the input. Figure 8 illustrates the preferred interconnection between the controller and the power amplifier. When driving unbalanced lines, pin 3 should be shorted to ground.

To hook up the DeltaMax™ controller to the power amplifiers, connect the LF Output of the controller to the input of the low-frequency amplifier and the HF Output of the controller to the input of the high-frequency amplifier. The outputs of the low- and high-frequency amplifiers are then connected to the LF input (woofer) and HF input (compression driver) respectively, of the DMS-1152/64 speaker system. See the LOUDSPEAKER CONNECTIONS section for details of the loudspeaker wiring. See Figures 9 and 10 for two typical system configurations.

Sense lines must be connected to the DeltaMax™ controller so that the power levels being delivered to the woofer and compression driver can be monitored. This is accomplished by connecting the output of the low-frequency amplifier to the LF Sense Input on the controller and the output of the high-frequency amplifier to the HF Sense Input on the controller. The sense input connectors are 5-way binding posts wired in a floating differential configuration. This configuration makes it possible to connect sense lines to a bridged amplifier without shorting out one of the legs of the amplifier. High-quality banana plugs may be used for these connections, but wires underneath the binding posts provide greater security. Small gauge wire (e.g. 22 gauge) is acceptable for these connections because there is minute current flow, but be sure the connections are secure and safe enough for the high voltages from the amplifier output.

The gain control bus in the DMC controllers is accessible through a two-conductor 1/4-inch jack on the back of the controller. This feature is used when it is desired for the gain of two or more units to track. Using a standard 1/4-inch patch cable, connect the jacks together. For more than two units, use Y-connectors. For example:

1. When multiple controllers and loudspeakers are used (such as in a stereo system), the controller's Gain Control jacks should be connected together to maintain level balancing and imaging.
2. When the DMC-1152X/DMS-1152/64 full-range system is used with the DMC-2181X/DMS-2181 subwoofer system, the controller's

INSTALLATION (continued)

Gain Control jacks should be connected together between the two controllers to ensure flat-frequency response when the controllers are operating in the protection mode.

Loudspeaker Connections

The DMS-1152/64 speaker system is equipped with 4-pin Neutrik Speakon™ NL4MPR connectors for electrical connection to the woofer and compression drivers. Each cabinet has two identical connectors with parallel wiring for connecting additional DMS speaker systems. The mating cable-end connector is the Neutrik Speakon™ NL4FC.

The pin connections are as follows:

Pin 1 – = LF (–)
Pin 1 + = LF (+)
Pin 2 – = HF (–)
Pin 2 + = HF (+)

Both the low-frequency and high-frequency inputs present a nominal eight-ohm load to the amplifier; however, the compression driver has a low-frequency protection capacitor in series.

Multiple Loudspeaker Arrays

Arrays consisting of multiples of identical DeltaMax™ loudspeaker systems can be implemented in a variety of ways. There does not need to be one controller for every speaker cabinet. Generally, there only needs to be as many controllers as there are different program sources. For example; a monaural program source requires one DMC-1152X controller; a stereo program source requires two DMC-1152X controllers; etc. In addition, a DMC-2181X/DMS-2181 subwoofer system may be added to a DMC-1152X/DMS-1152/64 system. The DMC-2181X is a stereo controller with left and right high outputs (above 80 Hz) and a mono-summed sub output (below 80 Hz). A monaural program source requires one DMC-2181X controller and one DMC-1152X controller; a stereo program source requires one DMC-2181X controller and two DMC-1152X controllers.

For the sake of simplicity, the following discussion will be confined to the various possible connection schemes for arrays of identical loudspeakers with only one program source and without subwoofers. (A stereo array can be broken down and analyzed as two separate arrays, each having a separate program source. Subwoofer wiring is addressed in the DMC-2181X Owner's Manual.) Amplifier inputs, outputs and sense lines will be addressed in the discussion.

The outputs (SUB OUT, LF OUT, HF OUT, etc.) of the DMC controllers are connected to the inputs of multiple amplifier channels through the use of Y-cords (or multiple Y-cords). The number of amplifier channels that can be driven by a single output of a controller is limited only by the total combined input impedance of the paralleled amplifiers. The DeltaMax™ controller outputs can drive a combined impedance of 600 ohms or greater. (For example, sixteen amplifiers, each having an input impedance of 10 k ohms, can be paralleled off of one DMC output.) If it is necessary to parallel additional amplifiers, line-level distribution amplifiers will have to be employed to drive the amplifier inputs. (Alternatively, multiple DMC controllers with paralleled inputs could be used to distribute the amplifier load.)

For the case where all of the DeltaMax™ loudspeakers are paralleled on the output of a single amplifier channel and only one controller is used, the sense line to that controller is connected to the output of the amplifier. In this case, all of the loudspeakers are driven at the same level and the controller monitors the voltage drive to each speaker. Make sure that the amplifier is calibrated for 32 dB of gain and that the controller is calibrated to the amplifier (see AMPLIFIER/CONTROLLER CALIBRATION section).

For the case where the Delta Max™ loudspeakers are powered by multiple amplifiers, all driven at the same level and only one controller is used, the sense line to that controller is connected to any one of the amplifier outputs. Note that this requires the use of identical amplifiers, each calibrated for 32 dB of gain and that the controller is calibrated to the amplifiers (see AMPLIFIER/CONTROLLER CALIBRATION section). Although the controller is only actually sensing one amplifier and one set of loudspeakers, they all are being protected equally as long as all of the amplifiers are performing identically.

For the case where the DeltaMax™ loudspeakers are powered by multiple amplifiers, each driven at different levels and only one controller is used, the sense line to that controller is connected to the output of the amplifier that is delivering the highest power levels to the loudspeakers. This is a fairly common occurrence; where the levels of individual loudspeakers in an array are adjusted to provide even room coverage. In this case, the amplifier being sensed must be calibrated for 32 dB of gain and the controller is calibrated to that amplifier. (See AMPLIFIER/CONTROLLER CALIBRATION section.) The other amplifiers must be identical to the one being sensed, with the exception that their levels are turned down as necessary to obtain even room coverage. Although the controller is actually sensing only one amplifier and one set of loudspeakers, they are all being protected because the one being driven the hardest is triggering the protection.

Note in the last two examples where multiple amplifiers are used to power multiple loudspeakers in an array, the level setting and calibration of the amplifiers are critical to ensure that all of the loudspeakers are protected with only one sense line. If in the normal course of operation the level settings of the am

INSTALLATION (continued)

plifiers are likely to be tampered with, the system should be set up with one controller per amplifier, allowing each set of speakers to be monitored. In this case, each amplifier would be calibrated for 32 dB of gain and any level adjustment of loudspeakers would be done with the Output Level trimpots on the controllers.

It should be noted that, when multiple DMS-1152/64 loudspeaker systems are closely assembled in an array, a build up of low and lower-mid frequencies can occur. The cause of this phenomenon is twofold. Mutual acoustic coupling between woofers at the lowest frequencies (typically below 100 Hz) results in increased efficiency and, hence, increased sound pressure level. (A similar effect occurs when a loudspeaker is placed near a boundary—a wall, a ceiling, a floor, etc.) In the upper-bass/lower-mid-range region (typically below 500 Hz), an array of multiple woofers will have greater directivity (a higher Q) than that of a single woofer, resulting in higher on-axis sound pressure levels. Because the equalization of the DMC-1152X controller is tailored to provide a flat acoustic frequency response with a single DMS-1152/64 loudspeaker, an over emphasis of the low and lower-mid frequencies can result when multiple loudspeakers are assembled together. The exact nature of this phenomenon will depend on the details of the array (the number of loudspeakers, their spacing, the splay angles, proximity to boundaries, etc.) An increase in acoustic response at these frequencies can result in low-frequency feedback or unwanted rumble. The controller features a low-frequency shelving equalization filter to compensate for the low-frequency build up from multiple loudspeakers. The user may adjust the cut-only filter by turning the LF SHELVING FILTER trimpot on the front panel counterclockwise. (Full clockwise rotation returns the controller/loudspeaker combination to a flat-frequency response.)

SPEAKER INSTALLATION

The DMS-1152/64APF is a flying version of the DMS-1152/64AP. Each cabinet has a total of four lengths of aircraft-type L-track rigging hardware (two on the top and two on the bottom). This two-point flying system makes maximum use of the trapezoidal cabinets, permitting a wide range of angle adjustment and offering maximum flexibility in array design and implementation for both the touring sound company and the sound contractor. The track accepts the New Haven NH32101-2 double-stud fittings, and the New Haven NH8192-2S and ancra 42546-10 single-stud fittings. Electro-Voice offers a complete line of flying accessories to be used with the DMS speaker systems.

***** CAUTION *****

The DMS-1152/64APF speaker systems should be suspended overhead only in accordance with the procedures and limitations specified in the DMS Loudspeaker System Flying Manual which is packed with each flying speaker system.

CONTROLLER INSTALLATION

Power Source

The DMC-1152X comes prewired from the factory for operation at 120 volts. To operate at 240 volts, the primary wiring of the power transformer must be altered.

***** CAUTION *****

Hazardous voltages and currents may be encountered within the chassis. The service information contained within this document is for use by Electro-Voice authorized warranty stations and qualified service personnel only.

To change the transformer primary wiring configuration use the following procedure:

1. Unplug the controller's power cord from the ac power source.
2. Remove the seven screws securing the top cover. There are two screws on each side, two screws on the rear and one screw in the front panel (center, top).
3. Locate the eight voltage select solder cups near the power transformer. Referring to Table 1, reconnect the leads corresponding to the desired primary voltage.
4. Install the correct line fuse. See values in Table II.
5. Plug the power cord into an ac outlet and turn the controller on. Measure the voltage at the points shown in the PCB diagram. The measured voltage should be ±22 volts. If the measured voltage is not within 10% of this value, turn the unit off and check the connections in step 3.
6. Reinstall the top cover with the seven screws.

Mounting

The unit is one rack-space high (1¾ in.) and fits a standard EIA 19-inch rack. To make wiring easier, mount the controller near the power amplifier(s).

Grounding

A widely accepted grounding technique for audio systems is the star connection (single-point) ground. The final configuration will be determined by the size of the system and the equipment used in the system. However, the star connection is recommended as a starting point.

The interconnecting cables of line level equipment, such as the DeltaMax™ controller should have the shields connected at one point only, usually the receiving end of the signal transmission.

Never lift the third wire safety ground of the ac power cable. It protects against possible shock hazard.

INSTALLATION (continued)

When deciding how to best ground the controller in a particular system, note that the controller's input and output XLR-type connectors have pin 1 referenced to chassis ground through a 20 k resistor and a .01µF capacitor. This minimizes the possibility of a ground loop. Circuit ground ties to the chassis ground internally at one point. The input to the controller is active differential and the output is transformer isolated.

Ventilation

Adequate ventilation should be proved in the rack to maintain a reasonable operating temperature. The ambient temperature inside the rack cabinet should not exceed 60 °C (140 °F) under any conditions.

Security

A security cover and attachment screws are supplied to protect the control settings against uninvited adjustments.

Maintenance

Use a soft damp cloth to clean the unit. No other maintenance is required.

SERVICE/WARRANTY INFORMATION

SHIPPING DAMAGE

Inspect the shipping carton for possible damage. If damage is found, notify the transportation company immediately. Save the carton as evidence for the carrier to inspect. If damage occurs during shipping, it is the responsibility of the consignee to file a claim with the carrier. If the carton is in good condition but the unit is damaged, call Electro-Voice.

Included in the box with the DeltaMax™ Controller is a power cord, warranty card, two operating voltage labels, a 1/10 amp fuse for 220-240 V ac, and this manual.

FIELD SERVICE

Controller power Inspection

If the DMC power indicator does not light:

1. Check the power switch.
2. Check the line cord.
3. Check the fuse.
4. Check the mains voltage and DMC operating voltage configuration.

SERVICING THE SPEAKER SYSTEM

The DMS-1152/64 was designed for expedient field service. The foam grille may be removed by simply grabbing a corner and gently peeling it off. Once the screws securing the steel grille are removed (using a #2 Phillips screwdriver), the grille may be lifted off. Loosening the four woofer clamp bolts (using a straight-blade screwdriver, or a 3/8-inch nut-driver or socket wrench) allows the woofer to be easily removed. Once the horn-mounting screws are re

Line Voltage	Line Fuse, MDL Series Slo-Blo
100 V ac	0.25 A/250 V
120 V ac	0.25 A/250 V
220 V ac	0.10 A/250 V
240 V ac	0.10 A/250V

TABLE II
Main Fuse Selection Guide

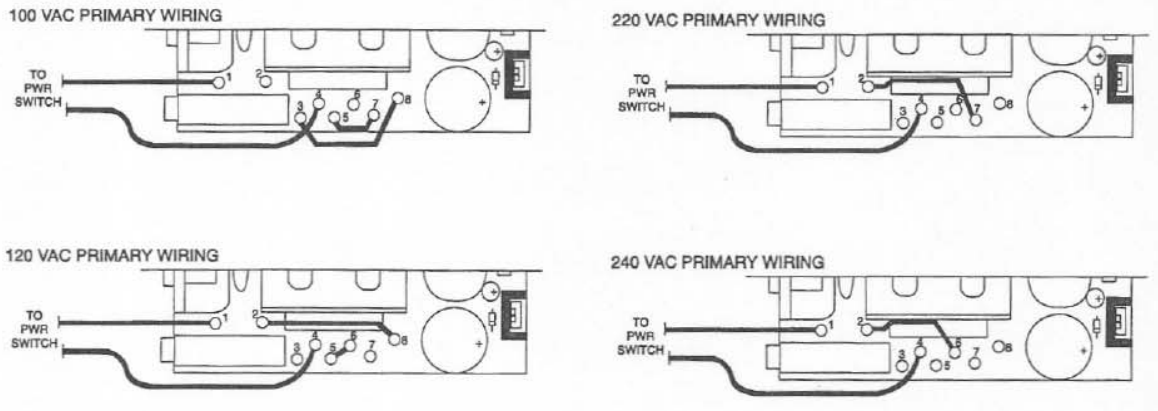


TABLE I
Primary Power Conversion Chart for 100-, 120-, 220- and 240-V, 50/60-Hz Operation

INSTALLATION (continued)

moved (using a #2 Phillips screwdriver), the compression driver may be accessed through both the horn and woofer cutouts in the baffle board and may be removed from the horn (using a 3/8-inch socket wrench). A woofer failure will require replacement of the entire driver. In the case of compression driver failure, a diaphragm assembly replacement kit with instructions is available; or, if desired, the complete driver may be returned for service.

Listed below are the available driver replacement and/or repair parts as well as a variety of other user serviceable items that are available from the Electro-Voice service department in Buchanan, Michigan:

	EV Part Numbers	
Item	DMS-1152AP/1152APF	DMS-1152MC
Complete woofer	815-1317	815-1317
HP driver diaphragm kit	81147XX	81147XX
Logo nameplate assy.	81680	81680
Foam grille	72713	72690
Steel grille assy.	81923	81872
Input panel sub-assy.	81866	82034
Connector (NL4MPR)	17305	17305
Cable Connector	17306	17306

WARRANTY (Limited)

Electro-Voice 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 Electro-Voice or any of its authorized service representatives. **Obtaining Warranty Service:** To obtain warranty service, a customer must deliver the product, prepaid, to Electro-Voice 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 Electro-Voice at 600 Cecil Street, Buchanan, MI 49107 (616/695-6831 or 800/234-6831) and/or Electro-Voice West, at 8234 Doe Avenue, Visalia, CA 93291 (209/651-7777 or 800/825-1242). **Incidental and Consequential Damages Excluded:** Product repair or replacement and return to the customer are the only remedies provided to the customer. Electro-Voice 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.

Electro-Voice Speakers and Speaker Systems are guaranteed against malfunction due to defects in materials or workmanship for a period of five (5) years from the date of original purchase. The Limited Warranty does not apply to burned voice coils or malfunctions such as cone and/or coil damage resulting from improperly designed enclosures. **Electro-Voice 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. **Electro-Voice Flying Hardware** (including enclosure-mounted hardware and rigging accessories) is guaranteed against malfunction due to defects in materials or workmanship for a period of one (1) year from the date of original purchase. Additional details are included in the Uniform Limited Warranty statement.

For warranty repair, service information, or a listing of the repair facilities nearest you, contact the service repair department at: 616/695-6831 or 800/685-2606.

For technical assistance, contact Technical Support at 800/234-6831 or 616/695-6831, M-F, 8:00 a.m. to 5:00 p.m. eastern standard time.

Specifications subject to change without notice.

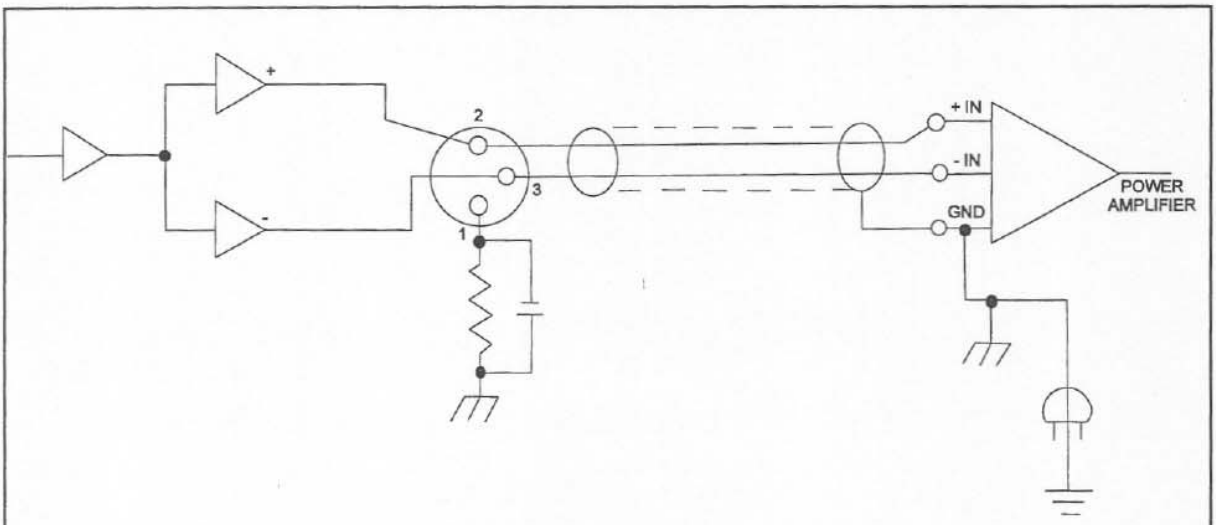


FIGURE 8—DeltaMax™ Output Connection

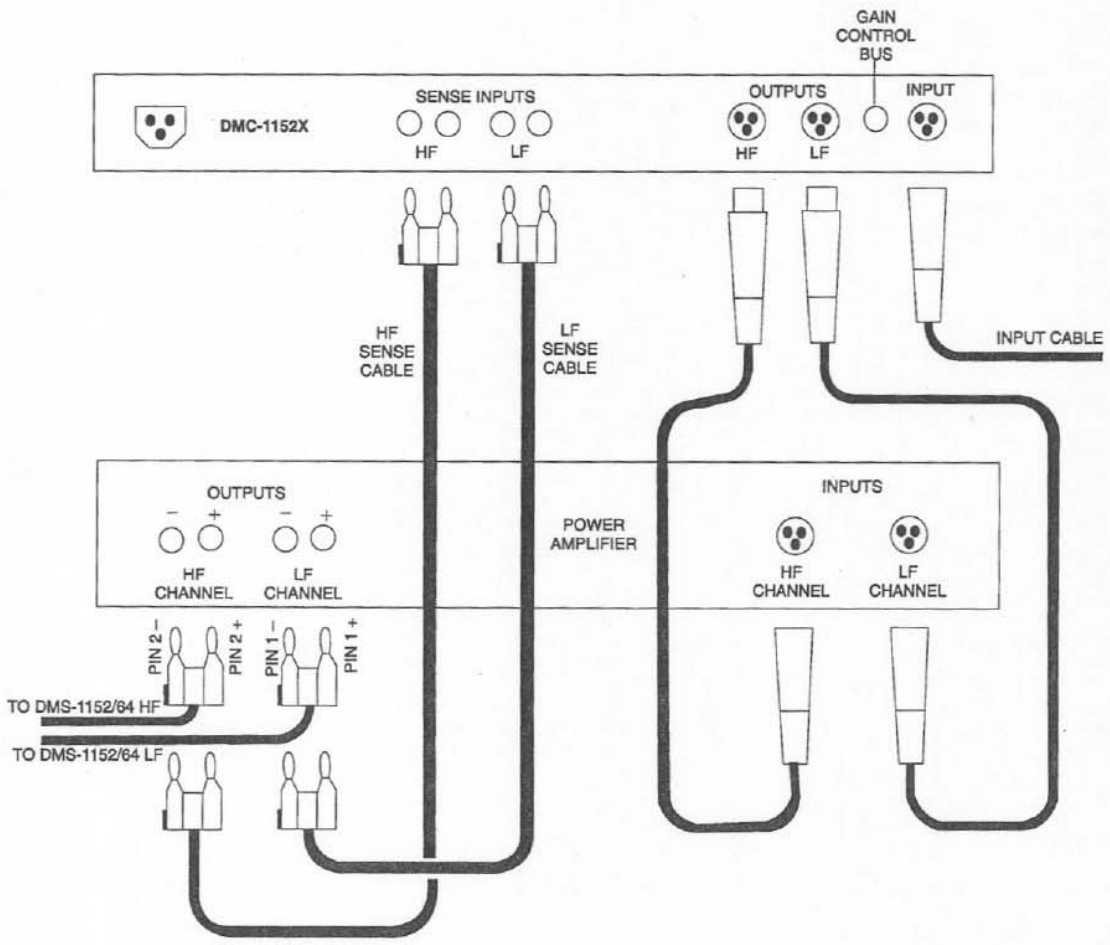


FIGURE 9—Interconnections for Single Channel Operation

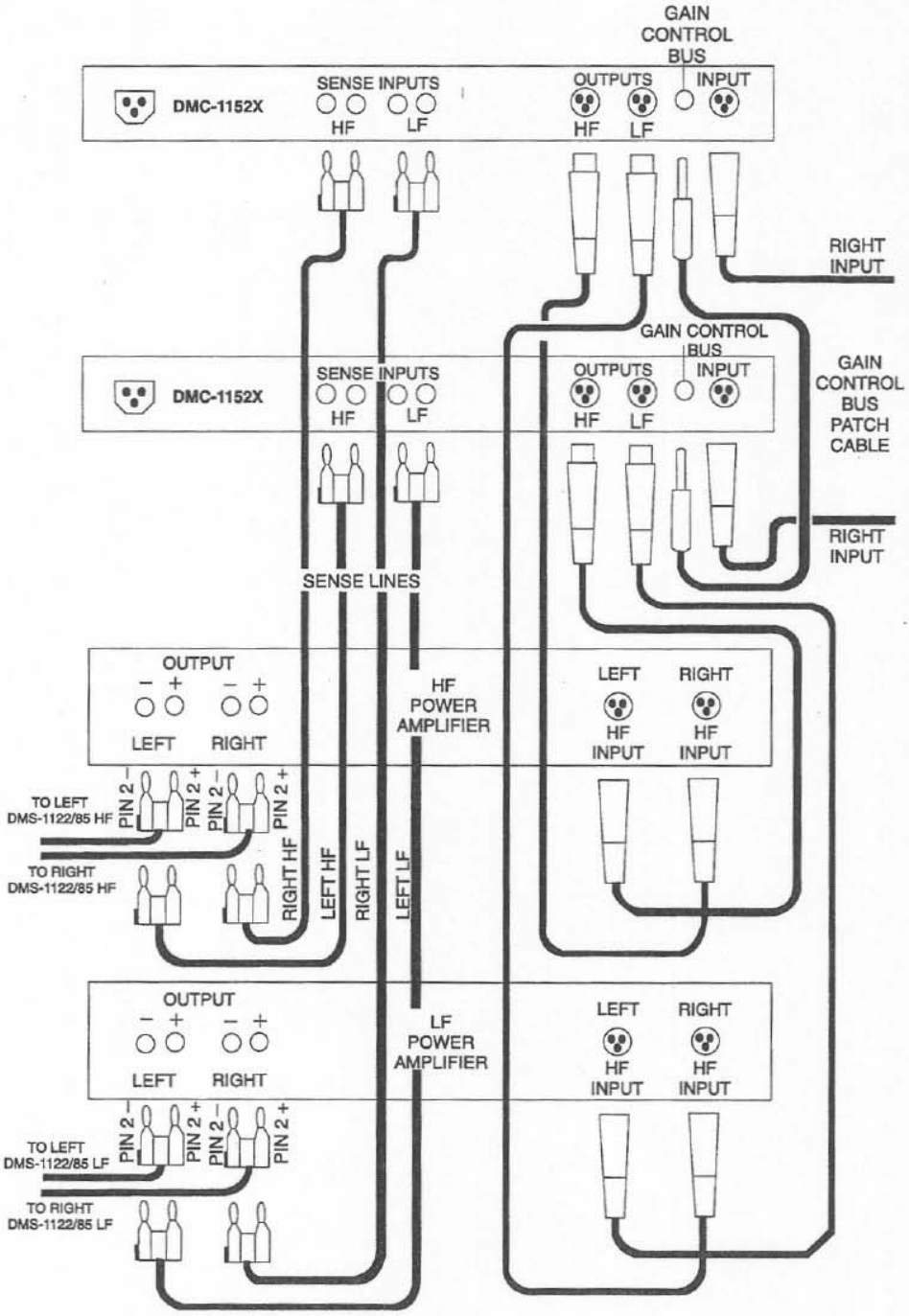
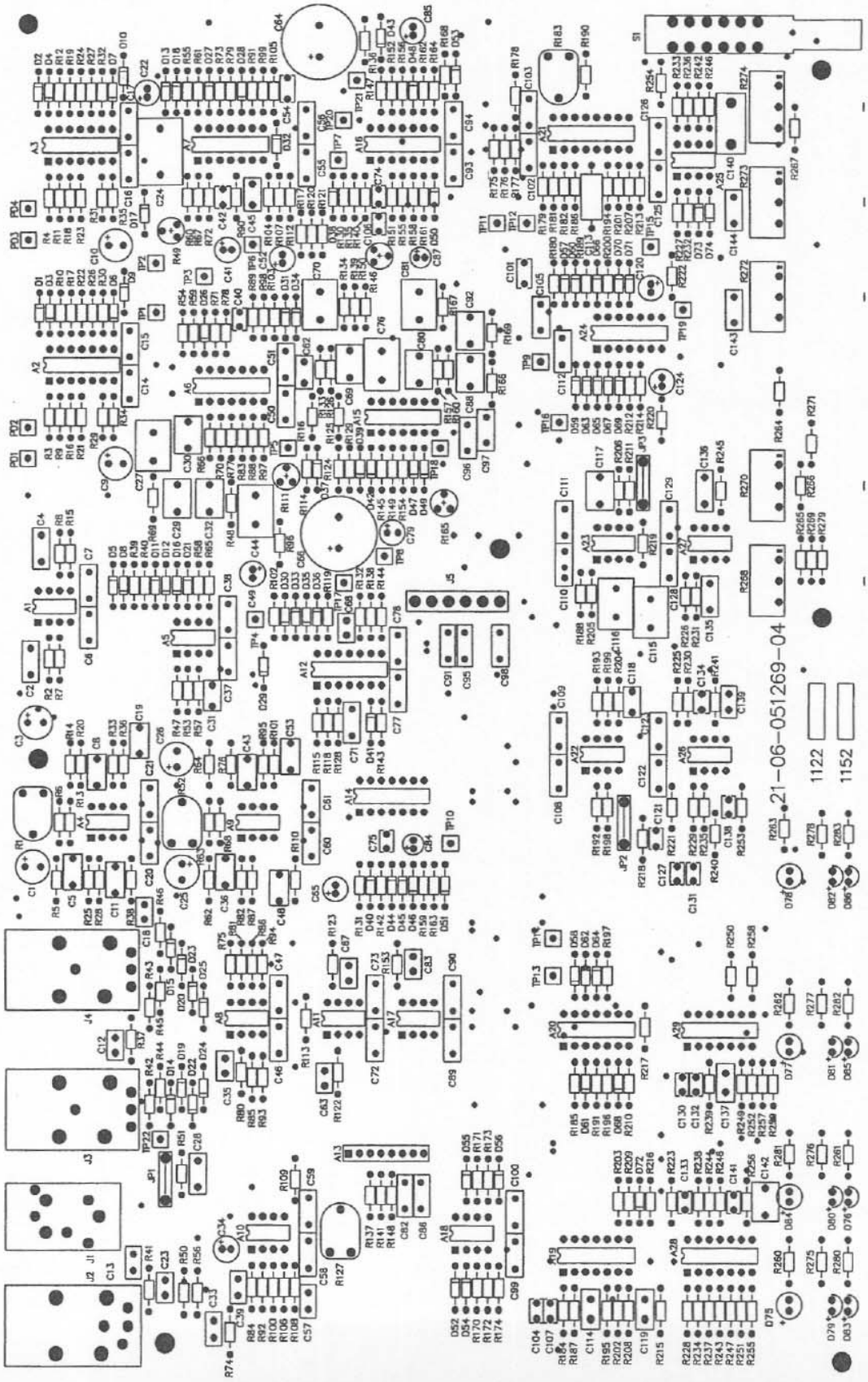
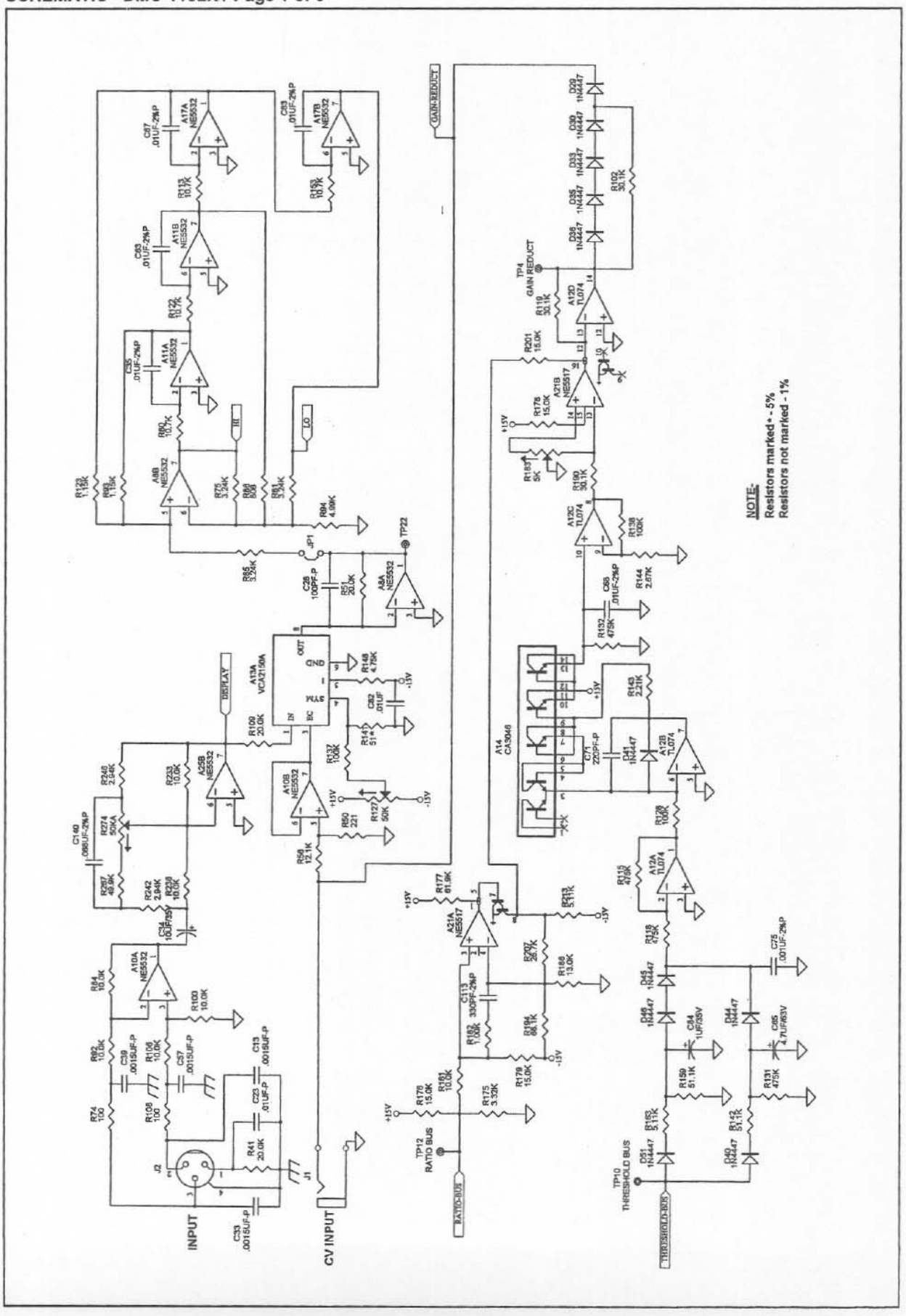


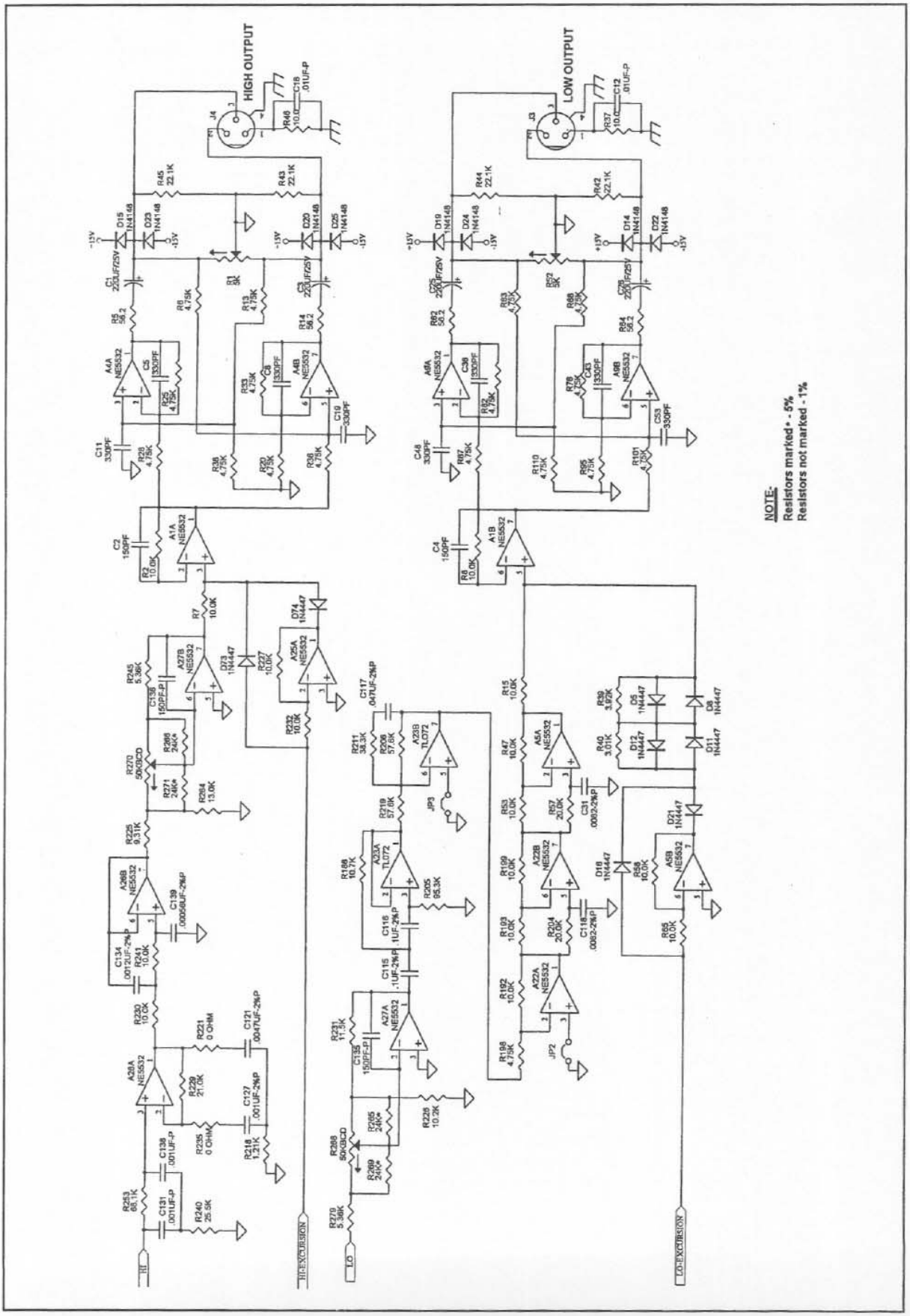
FIGURE 10—Interconnection for Stereo Operation

MAIN P.C. BOARD

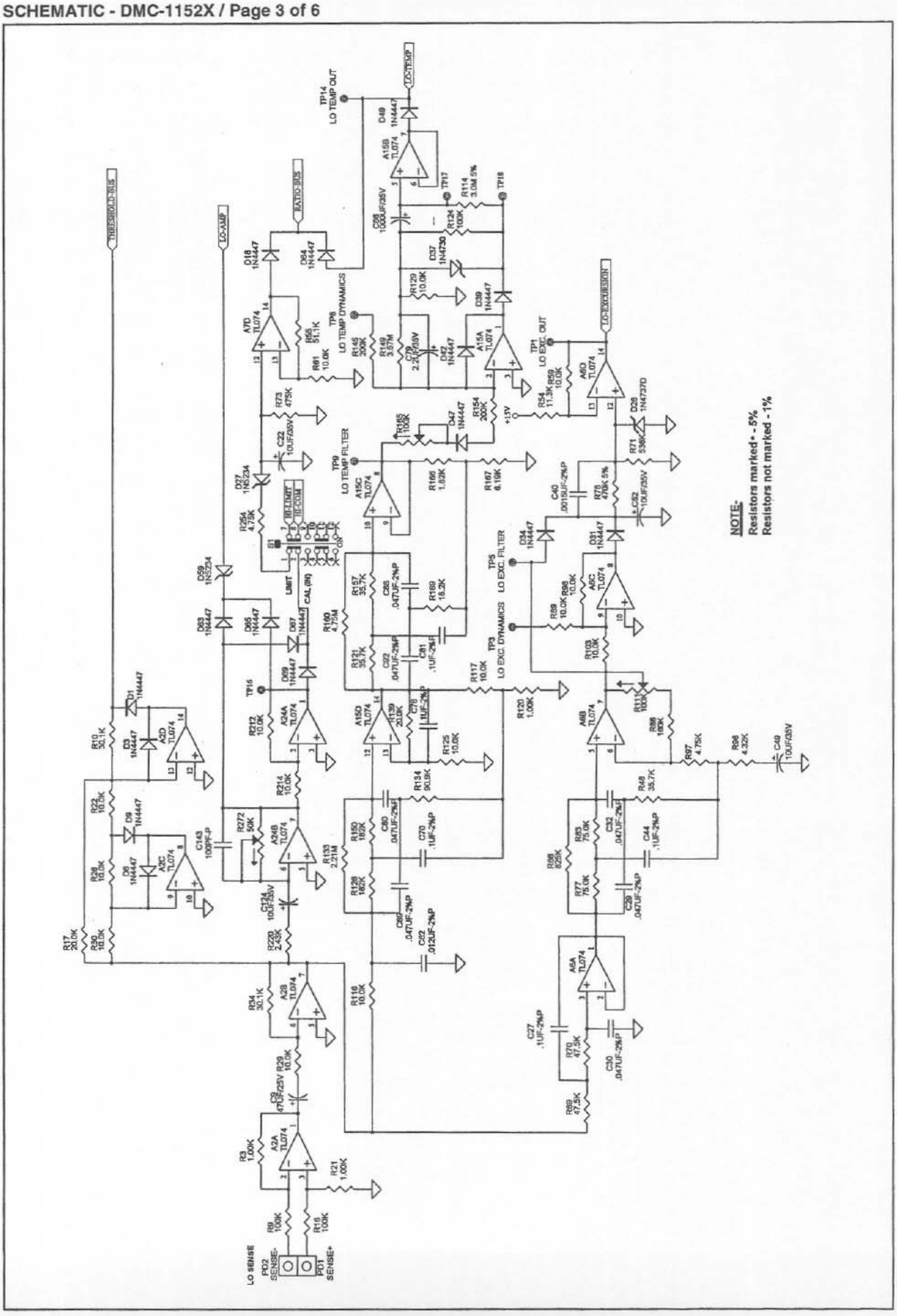


SCHEMATIC - DMC-1152X / Page 1 of 6

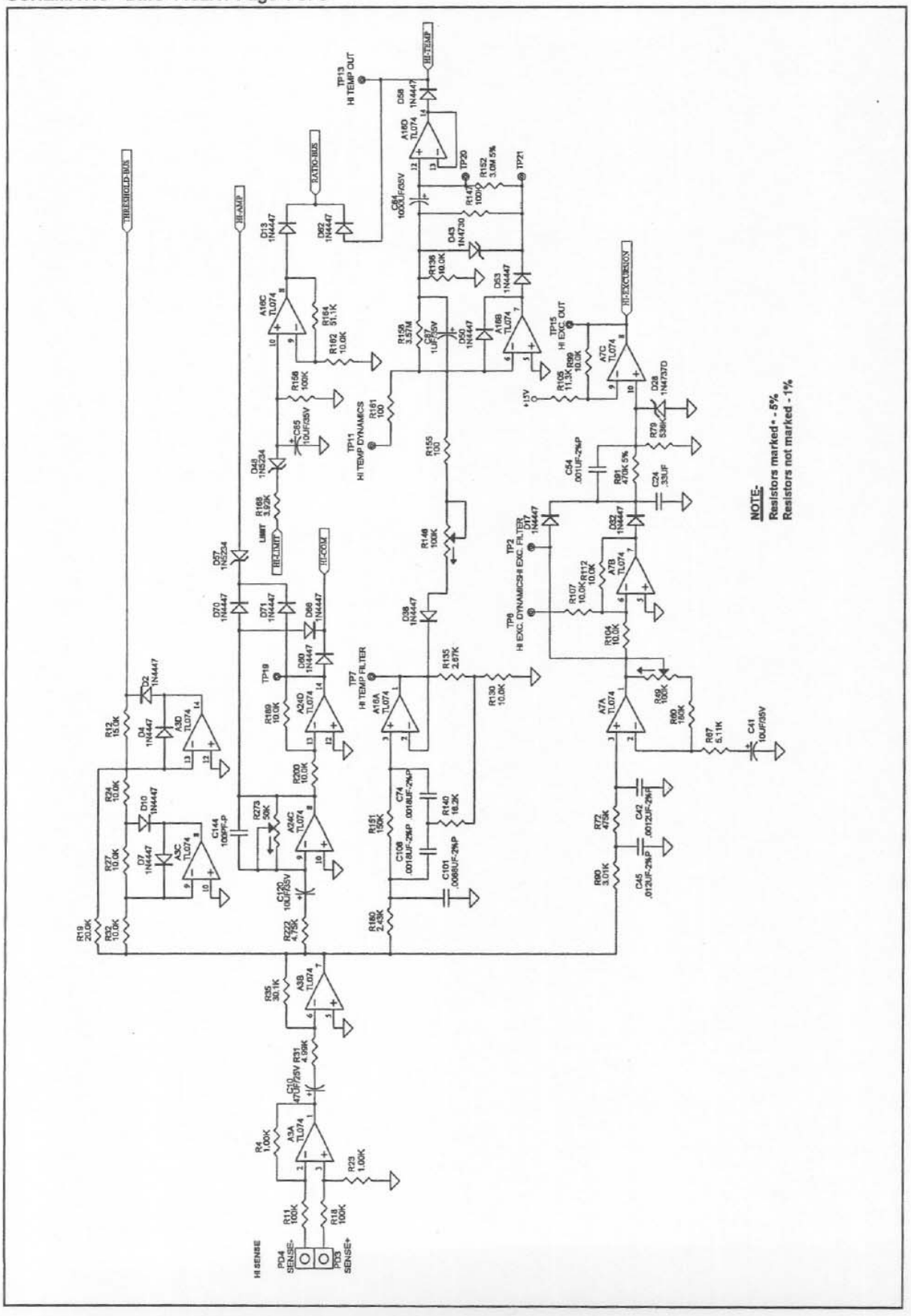



HIGH OUTPUT
LOW OUTPUT
NOTE:
Resistors marked* - 5%
Resistors not marked - 1%
RF
LO
RF-EXCURSION
LO-EXCURSION

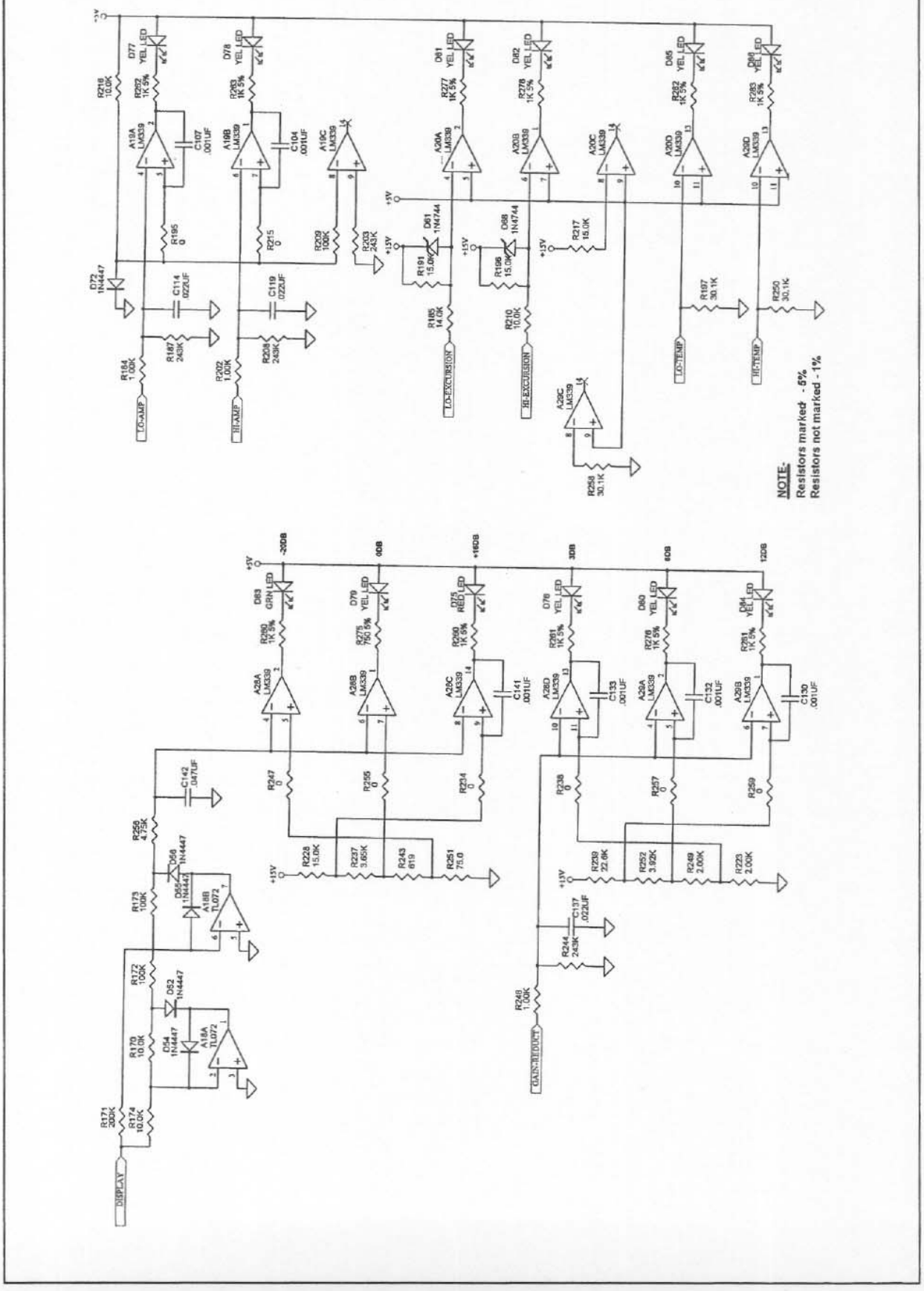
SCHEMATIC - DMC-1152X / Page 3 of 6



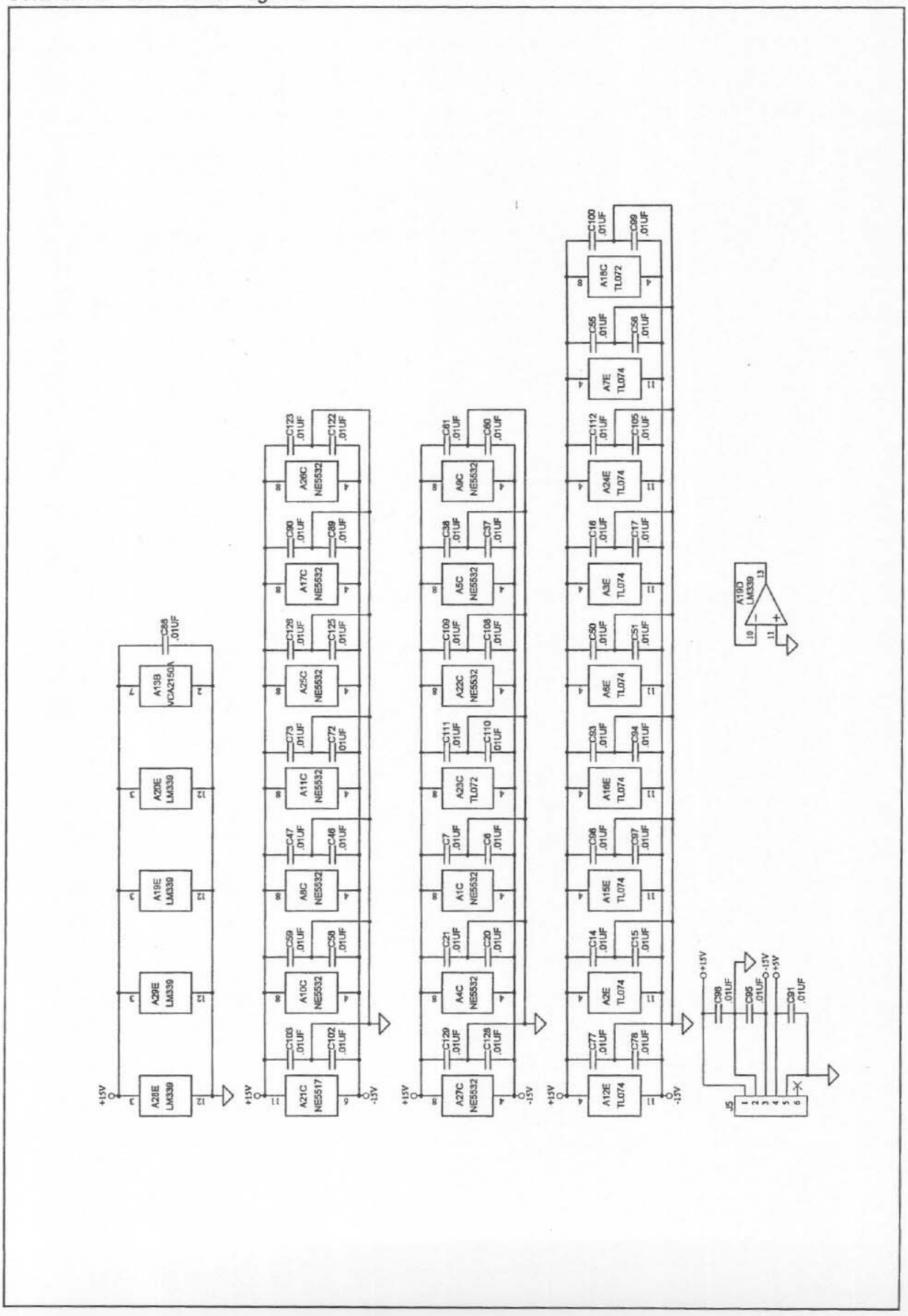
SCHEMATIC - DMC-1152X / Page 4 of 6



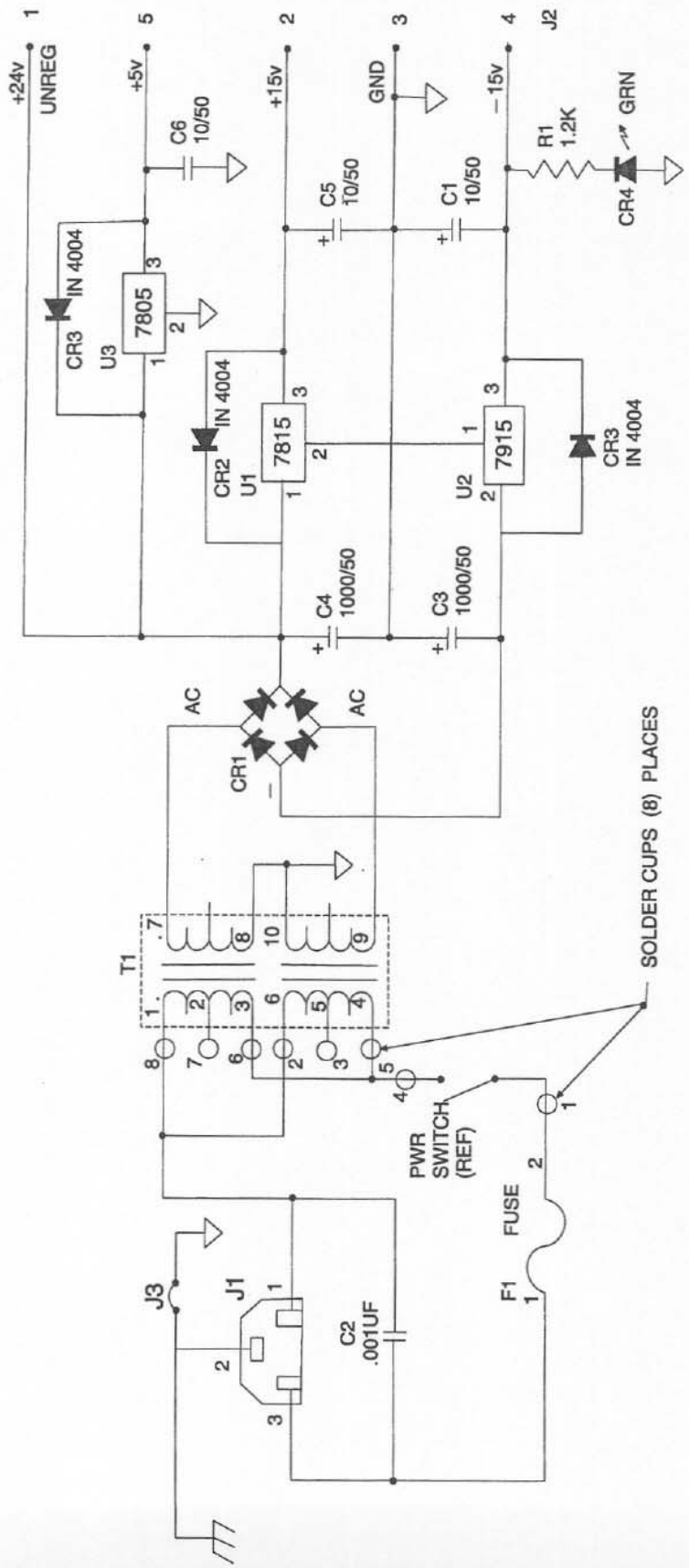
SCHEMATIC - DMC-1152X / Page 5 of 6



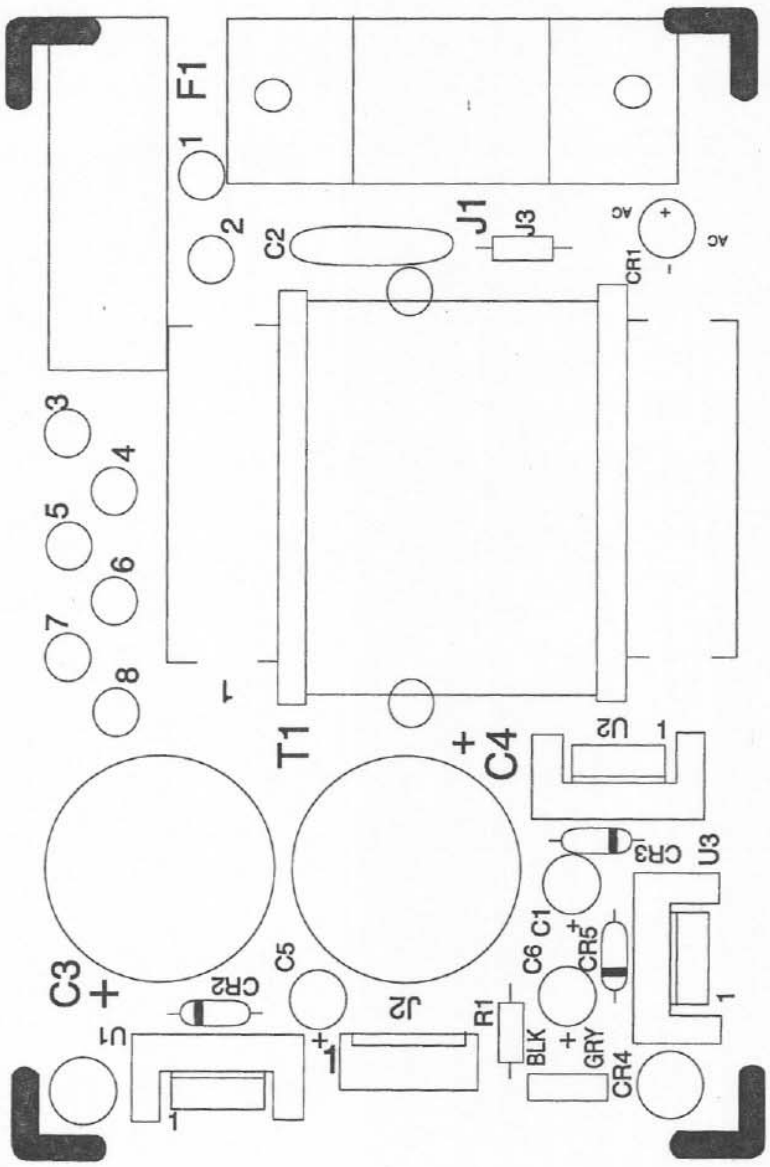
SCHEMATIC - DMC-1152X / Page 6 of 6



SCHEMATIC - DMC-1152X



POWER SUPPLY P.C. BOARD



Power Supply Board Assembly (27-01-038256)

C1, C5, C6	15-01-124502	Capacitor, 10uf, 50 volt, aluminum electroylitic, Radial Lead
C3, C4	15-01-124505	Capacitor, 100uf, 50 volt, aluminum electroylitic, Radial Lead
C2	15-02-026884	Capacitor, 0.01uf, 250 volt, ceramic, UL approved
U1	17-01-121660	I.C., voltage regulator, –15V, LM7815
U2	17-01-121659	I.C., voltage regulator, +5V, LM7805
U3	17-01-119087	I.C., voltage regulator, +5V, LM7915
CR1	48-02-037580	Bridge Rectifier, 1.5 amp, pc mount
CR2, CR3, CR5,	48-02-042787	Diode, 1N4004, 400V, 1A
CR4	39-01-124973	LED, green
F1	51-04-124634	Fuse, 175mA, 250V, slow blow
T1	56-08-025906	Transformer, power, pc mount

DMC-1152X Main Board Assembly

C64, C66	15-01-027317	CAP 1000MFD/35V ELEC AL RAD
C9, C10	15-01-027327	CAP 47MFD 20% 25V ELEC RAD
C65	15-01-028703	CAP 4.7UF 63V ELEC AL RAD
C84, C87	15-01-028850	CAP 1 MF 35V ELEC AL RAD
C79	15-01-028851	CAP 2.2 MF 35V ELEC AL RAD
C1, C3, C25, C26	15-01-051325	CAP 220UF/25V ALUMINUM RAD LEAD
C22, C34, C41, C49, C52, C85, C120, C124	15-01-122935	CAP 10UF 20% 35V ALUMNUM
C71	15-02-026831	CAP 220PF 10% 50V CER DISK
C2, C4, C135, C136	15-02-027325	CAP 150PF 5% 100V CERAMIC
C28, C143, C144	15-02-027455	CAP 100PF 10% 50V CERAMIC
C104, C107, C130, C132, C133, C141	15-02-051318	CAP .001UF Z5U CERAMIC
C5, C8, C11, C19, C36, C43, C48, C53	15-02-051435	CAP 330PF 5% 50V POLYPROPYLENE
C6, C7, C14 TO C17, C20, C21, C37, C38, C46, C47, C50, C51, C55, C56, C58, C59, C60, C61, C72, C73, C77, C78, C82, C86, C89, C90, C91, C93, C94, C95, C96, C97, C98, C99, C100, C102, C103, C105, C108, C109, C110, C111, C112, C122, C123, C125, C126, C128, C129	15-02-100307	CAP .01UF+80% 100V-Z5U CER
C54	15-06-026823	CAP .001 5% 50V MYLAR FILM
C13, C33, C39, C57	15-06-027320	CAP .0015MFD, 5%, 50V MYLAR
C142	15-06-027367	CAP .047MF 5% 50V MYLAR
C114, C119, C137	15-06-028020	CAP .022 MF 10% 50V MYLAR
C35, C63, C67, C68, C83, C12, C18, C23	15-06-028065	CAP .01 MF 2% 50V POLY
C101	15-06-028853	CAP .0068 MF 10% 50V MYLAR
C113	15-06-037470	CAP 330PF/400VDC
C75, C127, C131, C138	15-06-037649	CAP .001MF 2% 100V POLY
C121	15-06-037650	CAP .0047MF 2% 100V POLY
C29, C30, C32, C69, C80, C88, C92, C117	15-06-037651	CAP .047MF 2% 100V POLY
C40	15-06-037652	CAP .0015 mf 2% 100V POL
C27, C44, C70, C76, C81, C115, C116	15-06-037653	CAP .1MF 2% 100V POLY
C31, C118	15-06-037655	CAP .0082MF 2% 100V POLY
C42, C134	15-06-038210	CAP .0012UF 2% 100V POLY
C24	15-06-038211	CAP .33UF 2% 100V POLY
C74, C106	15-06-038212	CAP .0018UF 2% 100V POLY
C62, C45	15-06-038214	CAP .012UF 2% 100V POLY
C139	15-06-051319	CAP .00056UF 2%-P
C140	15-06-051326	CAP .068UF-2%P
A19, A20, A28, A29	17-01-028867	IC LM339 QUAD COMPARATOR
A13	17-01-028905	IC VOLTAGE CONTROLLED AMP
A14	17-01-028906	IC CA3046 XSTR ARRAY
A21	17-01-028907	IC NE5517N O.T.A.
A1, A4, A5, A8, A9, A10, A11, A17, A22, A25, A26, A27	17-01-122832	IC-BI 5532A-DUAL OP-AMP 4MV
A2, A3, A6, A7, A12, A15, A16, A24	17-01-124461	IC TL07 4CN QUAD OP-AMP
A18, A23	17-01-124688	IC TL072CP DUAL OP-AMP
J5	21-01-028470	HDR .045 SQ PST 6 PIN
J1	21-01-028908	CONN 1/4 PHO JCK, RGT ANGLE
R195, R215, R221, R234, R235, R238, R247, R255, R257, R259, JP1,2,3	21-01-110310	JMPR CIRCUIT
J2	21-01-124470	CONN XLR FEMRTANGPCMT GND
J3, J4	21-01-124642	CONN XLR MALE RTANG PCMT
D83	39-01-028846	LED 3.9V ROUND, GREEN
D75	39-01-028893	LED 2.0V ROUND, RED
D76 THRU D82, D84, D85, D86	39-01-028894	LED 2.0V ROUND YELLOW
R141	47-01-028860	RES 51 OHM 5% .25W CF AX
R114, R152	47-01-028863	RES 3MHM 5% .25W CF AX
R260, R261, R262, R263, R276, R277, R278, R280, R281, R282, R283	47-01-102078	RES 1 KHM 5% .25W CF AX
R265, R266, R269, R271	47-01-102111	RES 24 KHM 5% .25W CF AX
R88	47-01-102132	RES 160 KHM 5% .25W CF AX
R78, R91	47-01-109204	RES 470 KHM 5% .25W CF AX
R60	47-01-109298	RES 180 KHM 5% .25W CF AX
R187, R203, R208, R244	47-03-026839	RES 243 KHM 1% .25W MF AX
R151	47-03-026892	RES 150 KHM 1% .25W MF
R86	47-03-027328	RES 806 OHM 1% .25W MF AX
R207	47-03-027330	RES 26.7 KHM 1% .25W MF AX
R231	47-03-028177	RES 11.5 KHM 1% .25W MF

R198	47-03-028242	RES 4.75 KHM 1% .25W MF AX
R42, R43, R44, R45	47-03-028243	RES 22.1 KHM 1% .25W MF
R194, R253	47-03-028245	RES 68.1 KHM 1% .25W MF
R226	47-03-028253	RES 10.2 KHM 1% .25W MF
R185	47-03-028255	RES 14 KHM 1% .25W MF AX
R69, R70	47-03-028260	RES 47.5 KHM 1% .25W MF
R67, R163, R213	47-03-028695	RES 5.11 KHM 1% .25W MF AX
R169	47-03-029035	RES 18.2 KHM 1% .25W MF AX
R175	47-03-037660	RES 3.32 KHM 1% .25W MF AX
R66	47-03-037661	RES 825 KHM 1% .25W MF AX
R237	47-03-037662	RES 3.65 KHM 1% .25W MF AX
R77, R83	47-03-037665	RES 75 KHM 1% .25W MF AX
R74, R108, R155, R161	47-03-037770	RES 100 OHM 1% .25W MF AX
R160	47-03-037771	RES 4.75 MHM 1% .25W MFAX
R134	47-03-038076	RES 90.9 KHM 1% .25W MF AX
R149, R158	47-03-038077	RES 3.57 MHM 1% .25W MFAX
R133	47-03-038215	RES 2.21 MHM 1% .25WMFAX
R126, R150	47-03-038216	RES 182 KHM 1% .25W MFAX
R72, R73, R115, R118, R131, R132	47-03-038217	RES 475 KHM 1% .25W MFAX
R71, R79	47-03-038218	RES 536 KHM 1% .25W MFAX
R135, R144	47-03-038219	RES 2.67 KHM 1% .25W MF AX
R275	47-03-038220	RES 750 OHM 1% .25W MF AX
R50	47-03-038221	RES 221 OHM 1% .25W MF AX
R251	47-03-038222	RES 75 OHM 1% .25W MFAX
R96	47-03-038223	RES 4.32 KHM 1% .25W MF AX
R243	47-03-038717	RES 619 OHM 1% .25W MF AX
R242, R246	47-03-051335	RES 2.94 KHM 1% 1/4W MF AX
R5, F14, R62, R64	47-03-051434	RES 56.2 OHM 1% 1/4W MF
R245, R279	47-03-051462	RES 5.36 KHM 1% 1/4W MF AX
R17, R19, R41, R51, R57, R109, R139, R204	47-03-109434	RES 20 KHM 1% .25W MF AX
R2, R7, R8, R15, R22, R24, R26, R27, R29, R30, R32, R47, R53, R58, R59, R61, R65, R84, R89, R92, R98, R99, R100, R103, R104, R106, R107, R112, R116, R117, R125, R129, R130, R136, R162, R170, R174, R181, R189, R192, R193, R199, R200, R210, R212, R214, R216, R227, R230, R232, R233, R236, R241,	47-03-109437	RES 10 KHM 1% .25W MF AX
R223, R249	47-03-119012	RES 2 KHM 1% .25W MF AX
R177	47-03-119034	RES 61.9 KHM 1% .25W MF AX
R205	47-03-119172	RES 95.3 KHM 1% .25W MF AX
R9, R11, R16, R18, R124, R128, R137, R138, R147, R156, R172, R173,R209	47-03-119305	RES 100 KHM 1% .25W MFAX
R3, R4, R21, R23, R120, R182, R184, R202, R248	47-03-121532	RES 1 KHM 1% .25W MF AX
R80, R113, R122, R153, R188	47-03-121737	RES 10.7 KHM 1% .25W MF AX
R37, R46	47-03-122803	RES 10 OHM 1% .25W MFAX
R48, R121, R157	47-03-122861	RES 35.7 KHM 1% .25W MF AX
R229	47-03-123009	RES 21.0 KHM 1% .25W CFAX
R186, R264	47-03-123010	RES 13 KHM 1% .25W MF AX
R145, R154, R171	47-03-123011	RES 200 KHM 1% .25W MF AX
R12, R176, R178, R179, R191, R196, R201,R217, R228	47-03-124484	RES 15 KHM 1% .25W MF AX
R10, R34, R35, R102, R119, R190, R197, R250, R258	47-03-124615	RES 30.1 KHM 1% .25W MF AX
R166	47-03-124646	RES 1.82 KHM 1% .25W MF AX
R54, R105	47-03-124655	RES 11.3 KHM 1% .25W MF AX
R239	47-03-124657	RES 22.6 KHM 1% .25W MF AX
R240	47-03-124658	RES 25.5 KHM 1% .25W MF AX
R55, R142, R159, R164	47-03-124659	RES51.1 KHM 1% .25W MF AX
R219, R206	47-03-124660	RES 57.6 KHM 1% .25W MF AX
R6, R13, R20, R25, R28, R33, R36, R38, R63, R68, R76, R82, R87, R95, R97, R101, R110, R148, R222, R254, R256	47-03-124672	RES 4.75 KHM 1% .25W MF AX
R167	47-03-124673	RES 6.19 KHM 1% .25W MF AX
R218	47-03-124676	RES 1.21 KHM 1% .25W MF AX
R180, R220	47-03-124677	RES 2.43 KHM 1% .25W MF AX
R40, R90	47-03-124678	RES 3.01 KHM 1% .25W MF AX
R225	47-03-124683	RES 9.31 KHM 1% .25W MF AX
R56	47-03-124685	RES 12.1 KHM 1% .25W MF AX
R267	47-03-124695	RES 49.9 KHM 1% .25W MF AX
R31, R94	47-03-124696	RES 4.99 KHM 1% .25W MF AX
R75, R81, R85	47-03-124697	RES 3.24 KHM 1% .25W MF AX
R93, R123	47-03-124699	RES 1.15 KHM 1% .25W MF AX
R210	47-03-124805	RES 7.5 KHM 1% .25WMFAX
R39, R168, R252	47-03-124838	RES 3.92 KHM 1% .25W MF AX
R140	47-03-124930	RES 16.2 KHM 1% .25W MF AX
R143	47-03-124957	RES 2.21 KHM 1% .25W MF AX
R211	47-03-125123	RES 38.3 KHM 1% 1/4WRN55D MF
R268, R270	47-06-027344	POT 16MM VERT B50KHM K86 CC
R1, R52, R183	47-06-027459	POT 5 KHM TRIM
R272, R273, R274	47-06-028556	POT 50 KHM 20% 16MM VERT
R127	47-06-028818	POT 50K 10V PCB HORZ TRIM
R49, R111, R165, R146	47-06-028910	POT TRIM 100K 6MM
D1 TO D13, D16, D18, D21, D29 TO D36, D38 TO D42, D44 TO D47, D49 TO D56, D60, D62 TO D67, D69 TO D74	48-01-027340	DIO SIGNAL 1N4447
D27, D48, D57, D59	48-01-028163	DIO ZENER 6.2V 1N5234
D61, D68	48-01-028891	DIO ZENER 15V IN4730A
D37, D43	48-01-028896	DIO ZENER 3.9V IN4730A
D26, D28	48-01-037486	DIO ZENER 7.5V 1%IN4737D
D14, D15, D19, D20, D22, D23, D24, D25	48-01-051327	DIODE 1N418
S1	51-02-028058	SW PUSH VERT PC 4PDT 10F4 S