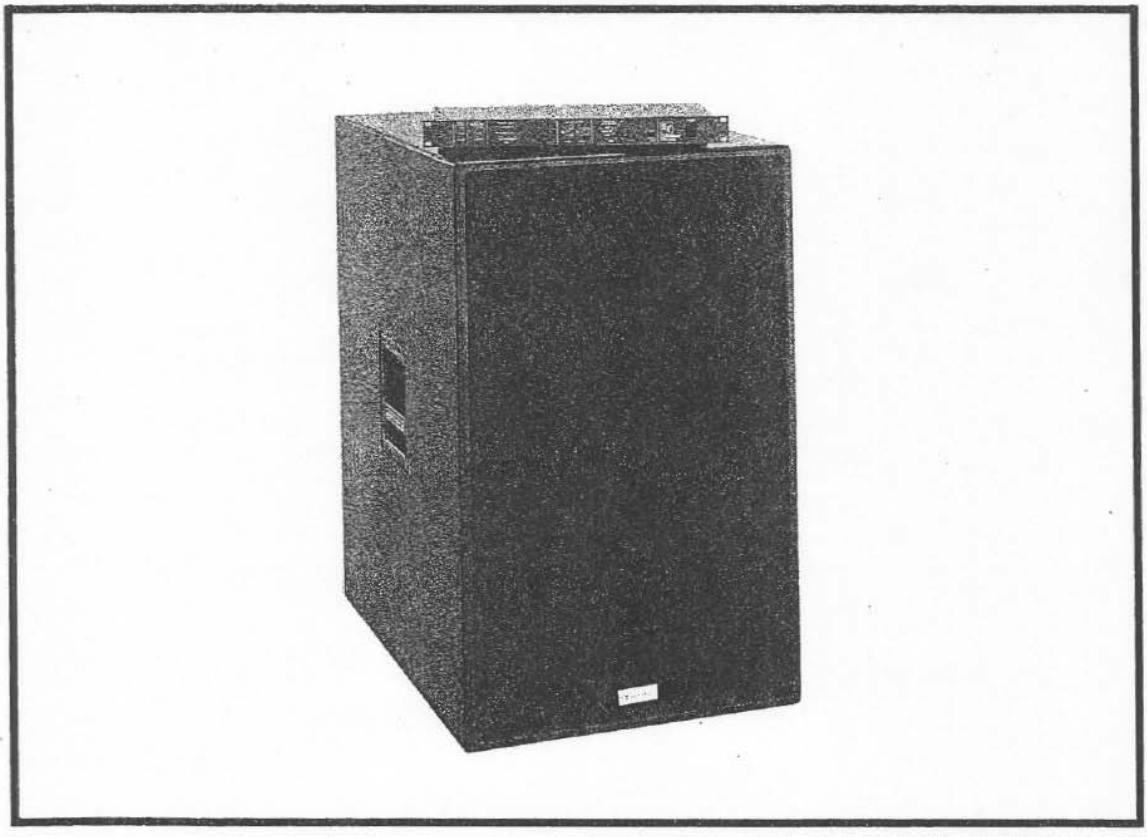
Electro-Voice®

THE DELTAMAX™ SYSTEM

OWNER'S MANUAL



DMC-2181 CONTROLLER
DML-2181A LOUDSPEAKER

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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/DML-2181A system consists of the DML-2181A high-performance Manifold Technology® subwoofer speaker system and the companion DMC-2181 electronic controller. The DMC/DML-2181A subwoofer system is intended for use with one of the full-range DeltaMax™ systems (such as the DMC/DML-1122A or DMC/DML-1152A) for high-level sound reinforcement in touring-sound and permanent-installation applications. The unique circuitry of the DMC-2181 controller provides accurate protection for the subwoofers without the use of shifting highpass or lowpass filters, shifting crossover frequencies, or independent bandpass compression; and the electronic protection is invoked only when catastrophic conditions are present for the subwoofers. The highpass output signal (above 100 Hz) is unprotected and is intended to be sent to the input of a full-range DMC-controller/DML-loudspeaker system. 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. The compact DML-2181A enclosure allows tight-cluster designs, enabling maximum mutual coupling and single-point-source arrays. There are two models in the DML-2181A series: the DML-2181AP (painted finish) and the DML-2181APF (painted finish with flying hardware).

The DML-2181A is a vented-box design comprised of two DL18MT 18-inch woofers, each facing into a manifold chamber at the center of the cabinet. Manifold Technology® (U.S. Patent No. 4,733,749) results in increased acoustic loading, yielding increased low-frequency efficiency and reduced distortion over conventional direct-radiating designs.

The DML-2181APF flying version includes three steel-reinforced, aircraft-type pan fittings on the top and bottom of the enclosure. These fittings ease the hanging of multi-cabinet arrays. Each DeltaMax™ flying system is packed with a separate owner's manual which provides specific hanging instructions.

The DMC-2181 circuits are designed to provide optimum audio performance, even when the audio drive level is increased for maximum loudness. Unusually accurate 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.

Optimum performance of the DML-2181AP and DML-2181APF will occur only when used with the DMC-2181. **Do not use with other electronic crossovers and/or processors.**

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.
- Connection to the compressor control voltage is available through a jack on the back panel. This allows precise gain tracking when more than one unit is in use, or between the subwoofer controller and other DeltaMax™ controllers.
- Front panel display shows the drive signal level and compressor gain reduction. Sensing display shows amplifier limit, excursion limit and temperature limit. When its limit is approached, each LED lights yellow.
- Speaker system is compact for tight-cluster array designs. Flying versions feature integral, steel-reinforced fittings to ease hanging.
- The woofers utilize the latest technology for high power and accurate sound reproduction.
- Manifold Technology® employed for maximum low-frequency loudspeaker performance.

CONTROLLER SPECIFICATIONS

CHANNEL CONFIGURATIONS —
Monaural two-way; one sense channel

FILTER TYPE —
4th-order Linkwitz-Riley

CROSSOVER FREQUENCY —
100 Hz

GAIN —
6 dB nominal, equalized sub output. Unity gain high output

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:
20,000 ohms
CMRR, Typical:
−55 dB
Connector:
Female 3-pin XLR-type

SENSE CHANNEL INPUT —
Type:
Floating differential
Maximum Level: 145 V rms
Impedance:
100 kilohms each side to ground
Connector: Two five-way binding posts

OUTPUTS (Sub and High) —
Type:
Transformer floating 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″ rack mount, 1.75″ high, 8.25″ behind panel (excluding connectors)
Supplied with front-panel security cover for controls.

SYSTEM SPECIFICATIONS — DML-2181A/DMC-2181

Frequency Response, Measured in Farfield Calculated to One Meter on Axis, Swept One-Third-Octave Pink Noise, 1 Watt into LF Midband (2.00 V at 70 Hz), Anechoic Environment:
36-100 Hz

Low Frequency 3-dB Down Point:
36 Hz

Sound Pressure Level at One Meter, One Watt Input Power, Anechoic Environment, Band-Limited Pink-Noise Signal, 50-100 Hz:
98 dB

Typical Maximum Continuous Sound Pressure Levels at One Meter, Anechoic Environment:
127 dB

Typical Maximum Peak Sound Pressure Levels at One Meter, Anechoic Environment:
133 dB

Crossover Frequency:
100 Hz

Beamwidth Angle Included by 6-dB-Down Points on Polar Responses, Indicated One-Third-Octave Bands of Pink Noise:
63-100 Hz horizontal (see Figure 3)
285° (+75°, −52°)

63-100 Hz vertical (see Figure 3)
240° (+120°, −77°)

Directivity Factor R_θ (Q):
63-100 Hz median (see Figure 4)
1.84 (+.36, −.37)

Directivity Index D_I:
63-100 Hz median (see Figure 4)
2.66 dB (+0.77 dB, −0.99 dB)

Distortion, Indicated SPL at 1 Meter, Shaped Spectrum Second Harmonic,
120 dB SPL (see Figure 5),
50 Hz: 1.4%
80 Hz: 1.2%

Distortion, Indicated SPL at 1 Meter, Shaped Spectrum Third Harmonic,
120 dB SPL (see Figure 5),
50 Hz: 2.0%
80 Hz: 2.5%

SPEAKER SPECIFICATIONS — DML-2181A

Transducer Complement:
Two DL18MT 18-inch woofers

Efficiency:
5.0%

Long-Term Average Power Handling Capacity Per EIA Standard RS-426A:
800 watts

Short-Term Power Handling Capacity (10 ms.):
3200 watts

Maximum Long-Term Midband Acoustic Output:
40 watts

Nominal Impedance:
Two 8-ohm loads (each woofer accessed individually)

Minimum Impedance:
Two 8.6-ohm loads (each woofer accessed individually)

Dimensions,
Height: 91.4 cm (36.0 in.)
Width: 57.2 cm (22.50 in.)
Depth: 75.9 cm (29.88 in.)

Net Weight:
74.5 kg (164 lb)

Shipping Weight:
79.5 kg (175 lb)

Enclosure Materials,
Structural:
¾-inch 14-ply birch plywood
Finish:
Black textured paint
Grille:
Steel with charcoal gray foam

Hanging (DML-2181APF only):
3-point flying system (accepts Aeroquip 32326 and 32343 fittings)

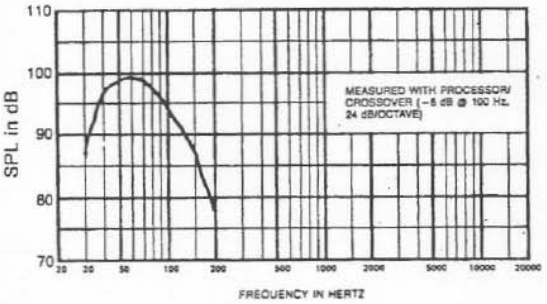


FIGURE 1 — DML-2181A/DMC-2181 Axial Frequency Response (1 watt/1 meter into LF midband)

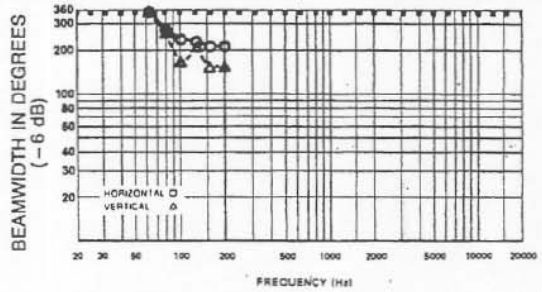


FIGURE 3 — DML-2181A Beamwidth vs. Frequency Whole Space (anechoic)

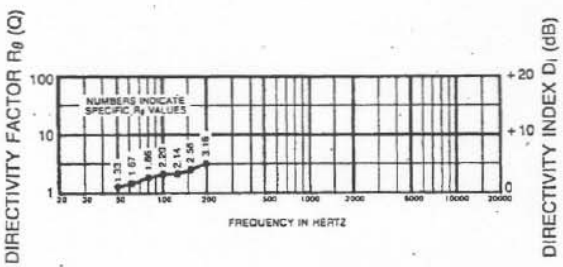


FIGURE 4 — DML-2181A Directivity Factor and Directivity Index vs. Frequency Whole Space (anechoic)

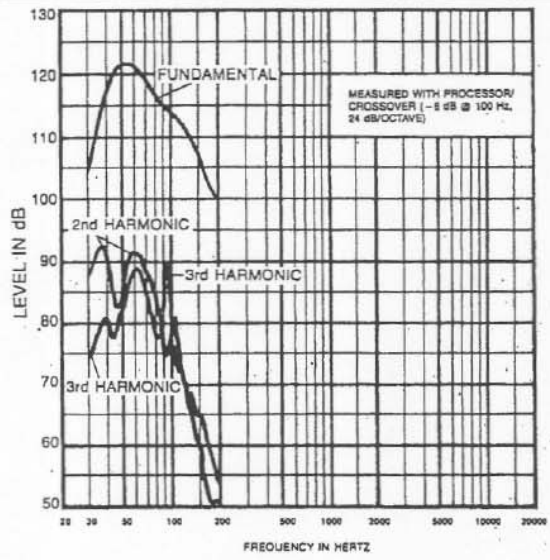


FIGURE 5 — DML-2181A/DMC-2181 Harmonic Distortion (120 dB SPL/1 meter)

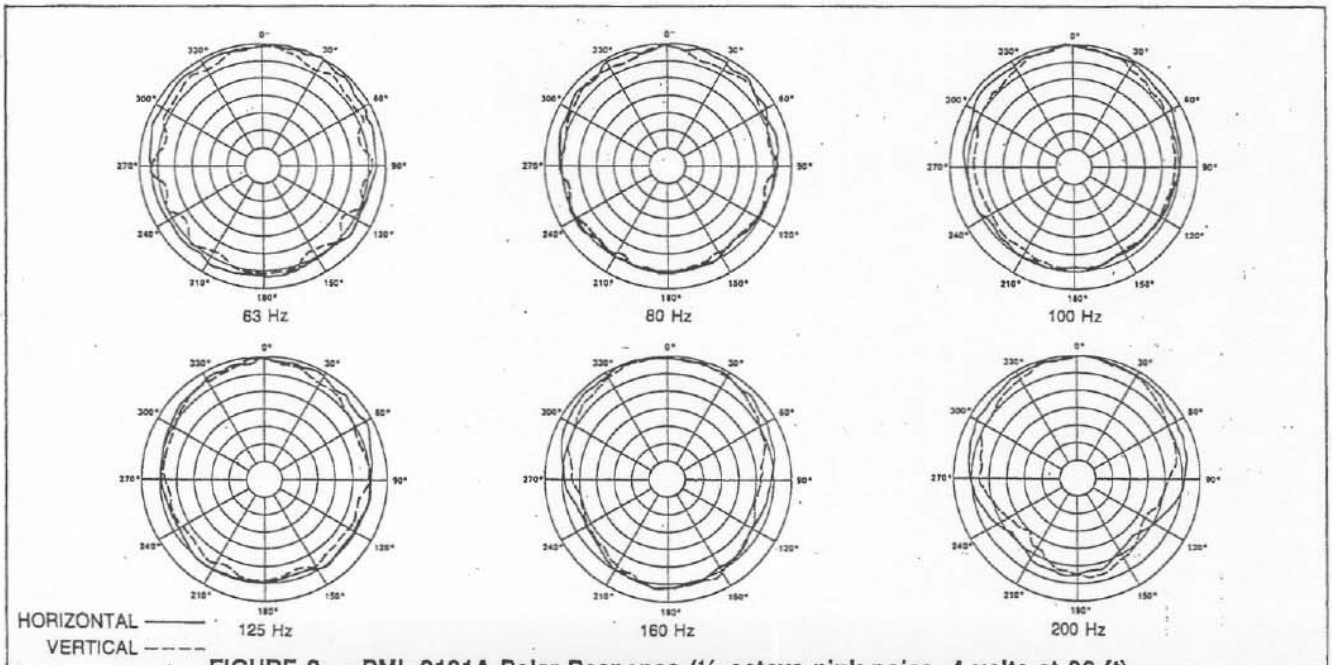
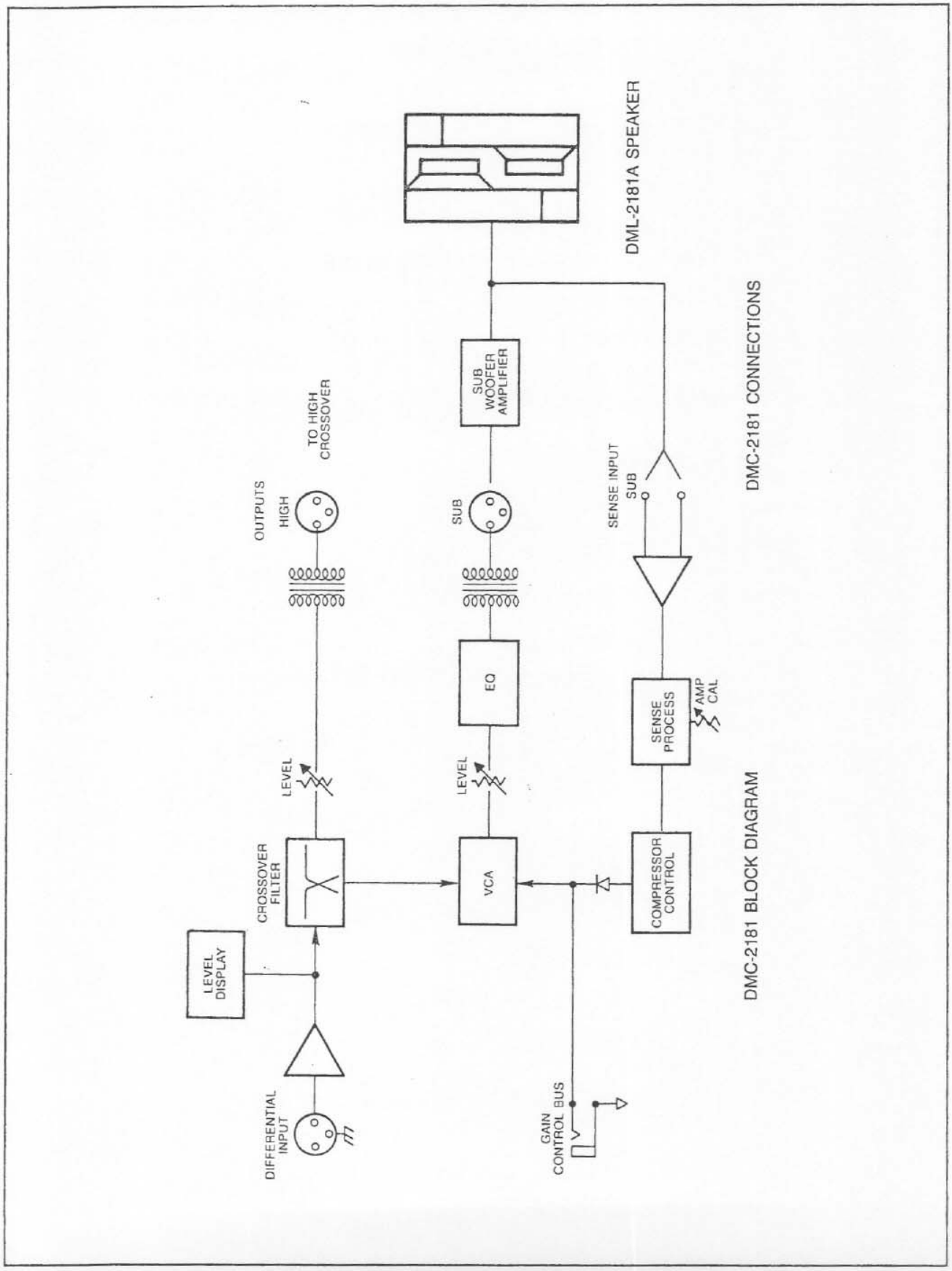


FIGURE 2 — DML-2181A Polar Response (⅓-octave pink noise, 4 volts at 20 ft)

BLOCK DIAGRAM



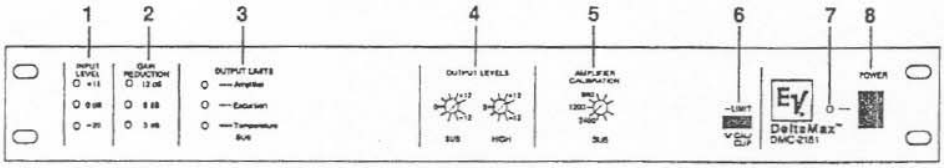


FIGURE 6 — DMC-2181 Front Panel

OPERATION

FRONT PANEL INDICATORS AND CONTROLS

1. INPUT LEVEL INDICATORS: Three LED's show the drive level at the input of the DMC-2181. 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 LED's 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 the subwoofers. 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 speakers 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 temperature of the subwoofer 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 the subwoofers.

   B. EXCURSION LIMIT: These LED's light when the excursion of the subwoofer cones approach their maximum allowable limit. Under this condition, voltage clamping will occur at the output of the subwoofer section so that the maximum-excursion limits will not be exceeded for the subwoofers.

   C. AMPLIFIER LIMIT: These LED's will provide status information for the subwoofer power amplifiers if the controller has been calibrated to the amplifiers — see the AMPLIFIER/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. SUB: This control adjusts the level of the subwoofer output signal (below 100 Hz). The control range is from −12 dB to +12 dB.

   B. HIGH: This control adjusts the level of the highpass output signal (above 100 Hz) sent to the input of a full-range DMC controller. The control range is from −12 dB to +12 dB.

   NOTE: The gain has been structured within the DMC-2181 controller so that when the DMC/DML-2181A combination is used with one of the full-range DeltaMax™ systems (like the DMC/DML-1122A or DMC/DML-1152A), the entire combination will have a flat-frequency response 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.

5. AMPLIFIER CALIBRATION CONTROLS: These controls are used for calibrating the controller to the subwoofer 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 1200 watts.)

OPERATION (continued)

6. 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 the subwoofer 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 LEDs 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.

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

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

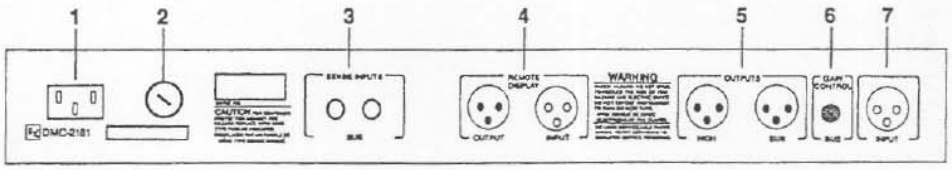


FIGURE 7 — DMC-2181 Back Panel

OPERATION

BACK PANEL CONNECTIONS

1. AC POWER CORD RECEPTACLE: This receptacle is for the provided ac power cord.

2. FUSE RECEPTACLE: This fuse receptacle requires either a 0.175A 250 V slow blow fuse (for 100/120 V ac operation), or a 0.100A 250 V slow blow fuse (for 220/240 V ac operation).

3. SUB SENSE INPUT: This input is for connection of the sense line to monitor the power delivered to the subwoofers and should be connected to the output of the subwoofer amplifier.

   NOTE: The Sense Input is a floating differential with a 5-way binding post. See CONNECTOR AND CABLE REQUIREMENTS section for detailed wiring information.

4. REMOTE DISPLAY: These connectors are reserved for future applications.

5. OUTPUTS:

   A. SUB: This connection is the subwoofer output (below 100 Hz) of the DMC crossover/controller and should be connected to the input of the subwoofer amplifier.

   B. HIGH: This connection is the highpass output (above 100 Hz) of the crossover/controller and should be connected to the input of a full-range DeltaMax controller.

   NOTE: The Sub and High outputs are transformer balanced XLR-type connectors having pin 1 as a ground reference, pin 2 high (+) and pin 3 (−). See CONNECTOR AND CABLE REQUIREMENTS section for detailed wiring information.

6. GAIN CONTROL BUS: This ¼-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.

7. 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 DML-2181A is a subwoofer loudspeaker system to be used with the DMC-2181 electronic controller. The DMC/DML-2181A subwoofer system is intended for use with one of the full-range DeltaMax™ electronically controlled loudspeaker systems (such as the DMC/DML-1122A or DMC/DML-1152A). Besides conventional frequency division, the DMC-2181 controller has equalization and time delay to obtain optimum performance from the DML-2181A when used with a full-range DeltaMax™ system. A sense line to the controller monitors the voltage drive to the subwoofers and automatically activates the protection circuitry to prevent cone overexcursion, voice-coil overheating and amplifier clipping. The high output is unprotected and is intended to be sent to the input of a full-range DMC-controller/DML-loudspeaker system. (Protection for the full-range speakers will take place in the full-range controller.) 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 controllers 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 DML 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.)

OPERATION (continued)

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 dBu 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 excursion of the subwoofer loudspeakers. If a a loudspeaker 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 drive signal as necessary to protect the drivers, while preserving the spectral balance and the relative program dynamics. When gain reduction occurs, an Output Limit Temperature LED will light indicating that the subwoofers are reaching their thermal limit. If a subwoofer approaches its maximum excursion limit, a dynamic frequency-sensitive voltage-clamping circuit at the output of the subwoofer 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 that the subwoofers are reaching their excursion limit.

The DMC-2181 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 the subwoofer amplifiers approach clipping, a multi-time-constant compressor-limiter circuit will reduce the peak and average levels of the drive 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 that the subwoofer amplifiers are reaching their 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 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 protection is occurring, selective equalization can be used (⅓-octave-band equalizer, parametric equalizer, etc.) to reduce 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/DML-2181A subwoofer system is used with a full-range DeltaMax™ system (such as a DMC/DML-1122A or DMC/DML-1152A), 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 voltage-clamping loudspeaker excursion 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 level control until the output of the amplifier measures 20 volts rms.

AMPLIFIER/CONTROLLER CALIBRATION (continued)

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 subwoofer power amplifiers.

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 two screws on the front panel of the controller. Perform the following procedure:

1. Connect the controller to the subwoofer power amplifier channels as detailed in the INSTALLATION section.
2. Be sure the controller Sub Sense Input is connected to the amplifier output and the **speakers are disconnected** from the amplifier.
3. Set the subwoofer 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 Sub Amplifier Calibration trimpot 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 ¼-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 40-Hz sinewave test signal to the controller input.
7. Adjust the signal source level until the subwoofer amplifier begins to clip (you may turn up the Sub 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 Sub Amplifier Calibration trimpot on the controller clockwise with a screwdriver until the Sub 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 that this is the maximum amount of power capable of being delivered to a single driver in this amplifier configuration.
9. **Remove the shorted ¼-inch phone plug from the Gain Control Bus jack** and set the Cal/Clip Limit switch to the Limit position (out). Set the Sub Output Level control to its center-detent position (or as desired).
10. Turn the amplifier off and connect the speaker cables to the output of the amplifier. Be sure to observe polarity when making these 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. 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 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.

   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 Output Level controls on the controller to change power amplifier drive levels.

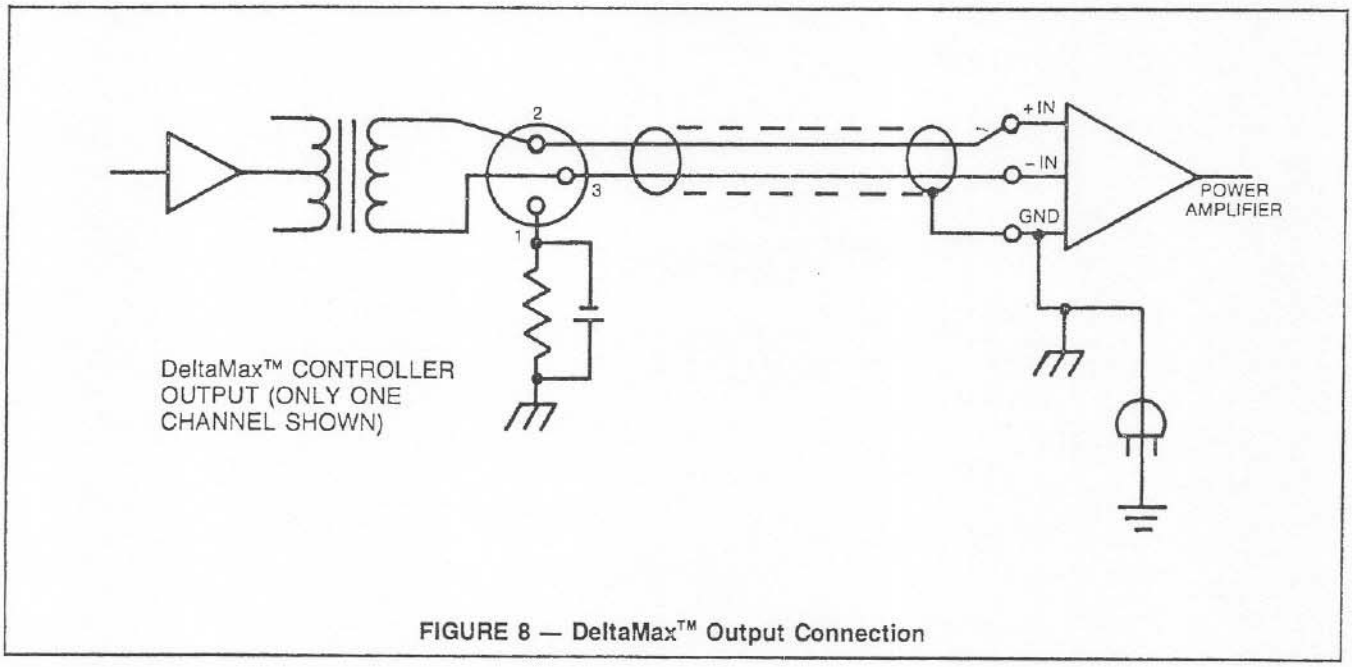


FIGURE 8 — DeltaMax™ Output Connection

INSTALLATION

AMPLFIFIER REQUIREMENTS

The DML-2181A subwoofer system contains two 8-ohm drivers. Each system utilizes a 4-pin electrical connector that allows each driver to be accessed separately. There are two ways the system may be powered:

1. Each driver may be connected to its own separate amplifier channel. In this configuration, each amplifier channel should have a power rating of 400-600 watts into eight ohms. The amplifier channels must be identical, having the same voltage gain and power rating.
2. The two drivers may be paralleled to one amplifier channel. The speakers should be paralleled at the amplifier, not at the cabinet. In this configuration, the amplifier channel should have a power rating of 800-1200 watts into four ohms.

DML-2181A systems may be paralleled (in either of the above configurations) with other DML-2181A systems if the amplifier is capable of delivering adequate power to each speaker at the lower impedance.

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 transformer 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 DMC-2181 controller to the power amplifier, connect the Sub Output of the controller to the input of the subwoofer amplifier. If two amplifier channels are used, a Y-cord should be used to direct the signal into the input of both amplifiers. The High Output of the controller is connected to the input of a full-range DeltaMax™ controller (like the DMC-1122A or DMC-1152A).

The outputs of the subwoofer amplifiers are then connected to the DML-2181A speaker system. For the configuration where each driver is driven by its own amplifier (see Figure 9): connect one driver in the DML-2181A to one amplifier making Pin 1 – negative and Pin 1 + positive, and connect the other driver to the second amplifier making Pin 2 – negative and Pin 2 + positive. For the configuration where the two drivers are paralleled on a single amplifier channel (see Figure 10): connect both drivers to the amplifier channel by making Pin 1 – and 2 – negative and Pins 1 + and 2 + positive. See the LOUDSPEAKER CONNECTIONS section for details of the loudspeaker wiring.

A Sense line must be connected to the DMC-2181 controller so that the power levels being delivered to the subwoofer drivers can be monitored. For the configuration where each driver is driven by its own amplifier: connect the output of one of the subwoofer amplifiers to the Sub Sense Input on the controller. (Do not connect another sense line to the output of the other amplifier — that would short the two amplifiers together.) Note that because the amplifiers are identical and both drivers are driven at the same level, both will be protected by the controller. For the configuration where the two drivers are paralleled on a single amplifier channel: connect the output of that subwoofer amplifier to the Sub Sense Input on the controller. The sense input connector is a 5-way binding post 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.

INSTALLATION (continued)

The gain control bus in the DMC controllers is accessible through a two-conductor ¼-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 ¼-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-1122A/DML-1122A and DMC-1152A/DML-1152A full-range systems are used with the DMC/DML-2181A subwoofer system, the controller's 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 DML-2181A subwoofer speaker system is equipped with 4-pin Neutrik Speakon™ NL4MP-R connectors for electrical connection to the two subwoofer drivers. Each cabinet has two identical connectors with parallel wiring for connecting additional DML speaker sytems. One mating Neutrik Speakon™ NL4FC cable-end connector is supplied with each system.

Cables, connectors and wiring accessories are available for the DML speaker systems from Pro Co Sound, Inc., and Whirlwind Music Distributors, Inc. To find your local Pro Co, Whirlwind or Neutrik dealer, contact:

Pro Co Sound, Inc.
135 E. Kalamazoo Ave.
Kalamazoo, MI 49007

Whirlwind Music Distributors, Inc.
P.O. Box 1075
Rochester, NY 14603

Neutrik USA, Inc.
195-S3 Lehigh Ave.
Lakewood, NJ 08701

The pin connections are as follows:

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

Both low-frequency inputs present a nominal eight-ohm load to the amplifier.

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 conroller 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 controller; a stereo program source requires two controllers, etc. 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. (A stereo array can be broken down and analyzed as two separate arrays, each having a separate program source.) 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 DeltaMax™ 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 occurence; 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,

INSTALLATION (continued)

in the normal course of operation, the level settings of the amplifiers 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.

SPEAKER INSTALLATION

The DML-2181APF is flying version of the DML-2181AP. Each cabinet has a total of six steel-reinforced aircraft-type pan fittings (three on the top and three on the bottom). This three-point flying system makes maximum use of the compact 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 pan fittings mate with the Aeroquip 32343 and 32326 twelve-jaw fittings. Electro-Voice offers the DMS series of rigging hardware; a complete line of flying accessories to be used with the DML speaker systems.

***** CAUTION *****

The DML-2181APF speaker systems should be suspended overhead only in accordance with the procedures and limitations specified in the DML-2181AF Flying Manual which is packed with each flying speaker system.

CONTROLLER INSTALLATION

Power Source

The DMC-2181 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 DMC-2181 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 voltage selection terminal strip mounted on the bottom of the chassis near the power transformer. The transformer has six primary leads, five of which are connected to the terminal strip in the following order:

Position #	Wire Color
1	Black
2	Violet
3	Blue
4	Violet/White
5	Blue/White

A sixth black/white lead and the two black leads from the fuse holder attach to the terminal strip with solderless connectors. Select primary operating voltages by moving these three connectors to the appropriate location. See Table I for correct connectors for the selected mains voltage.

4. Install the correct line fuse. See values in Table II.

Line Voltage	Line Fuse, Slow-Blow
100 V ac	0.175 A/250 V
120 V ac	0.175 A/250 V
220 V ac	0.100 A/250 V
240 V ac	0.100 A/250 V

TABLE II
Main Fuse Selection Guide

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 ±29 volts. If the measured voltage is not within 10% of this value, turn the unit off and check the connections in step 3.
6. Install the top cover with the seven screws.

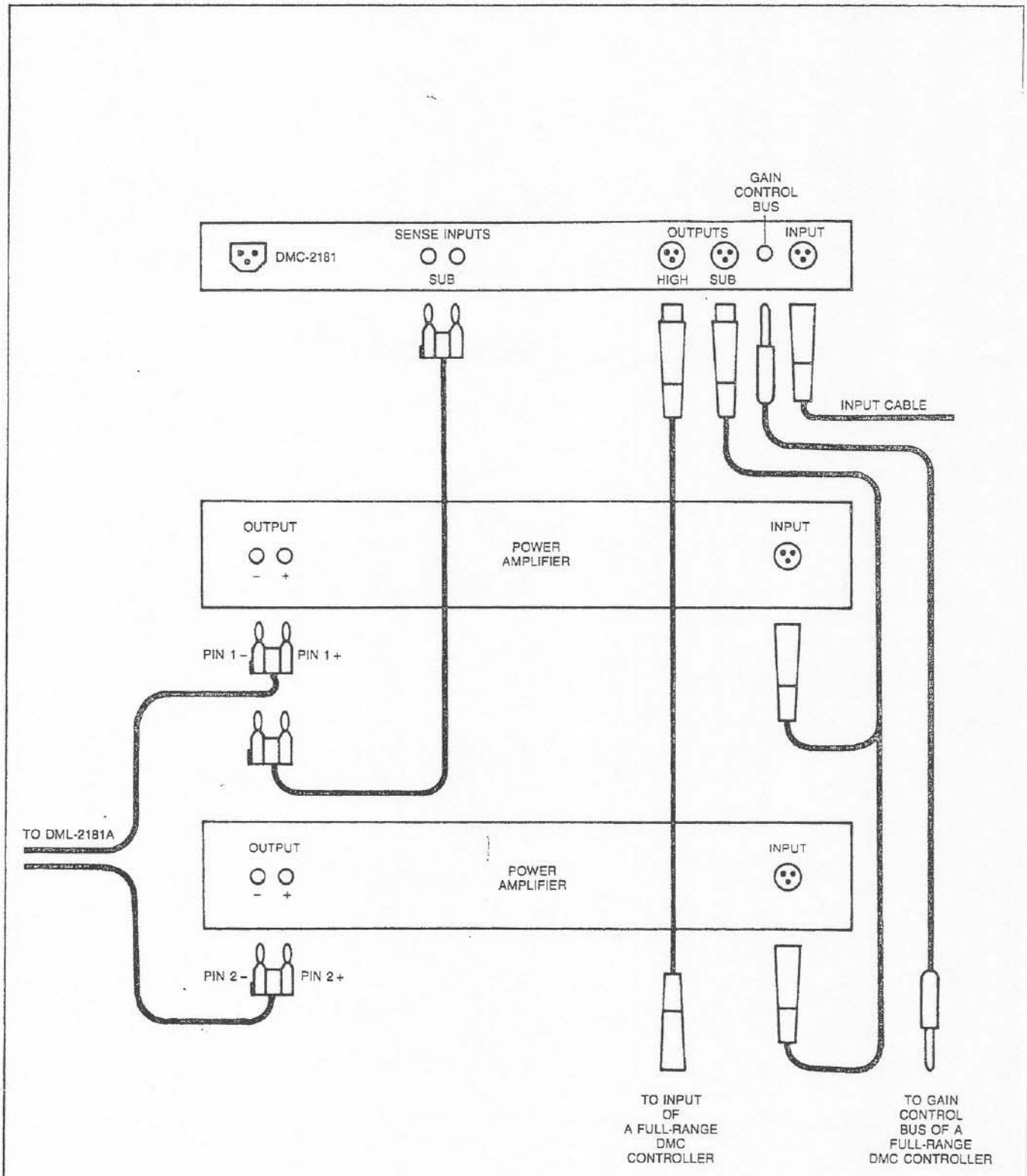


FIGURE 9 — Drivers Connected to Two Separate Amplifier Channels

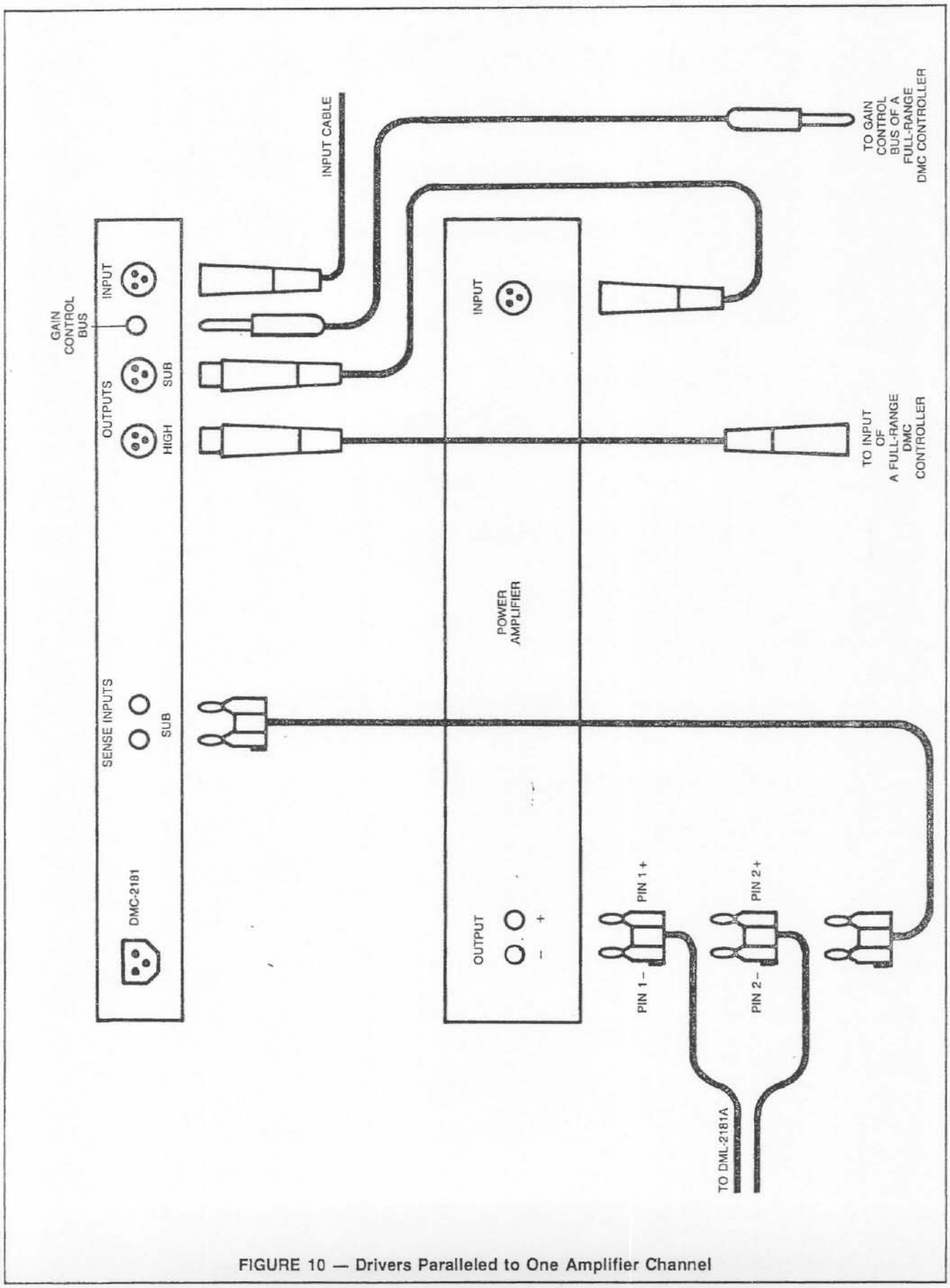


FIGURE 10 — Drivers Paralleled to One Amplifier Channel

INSTALLATION

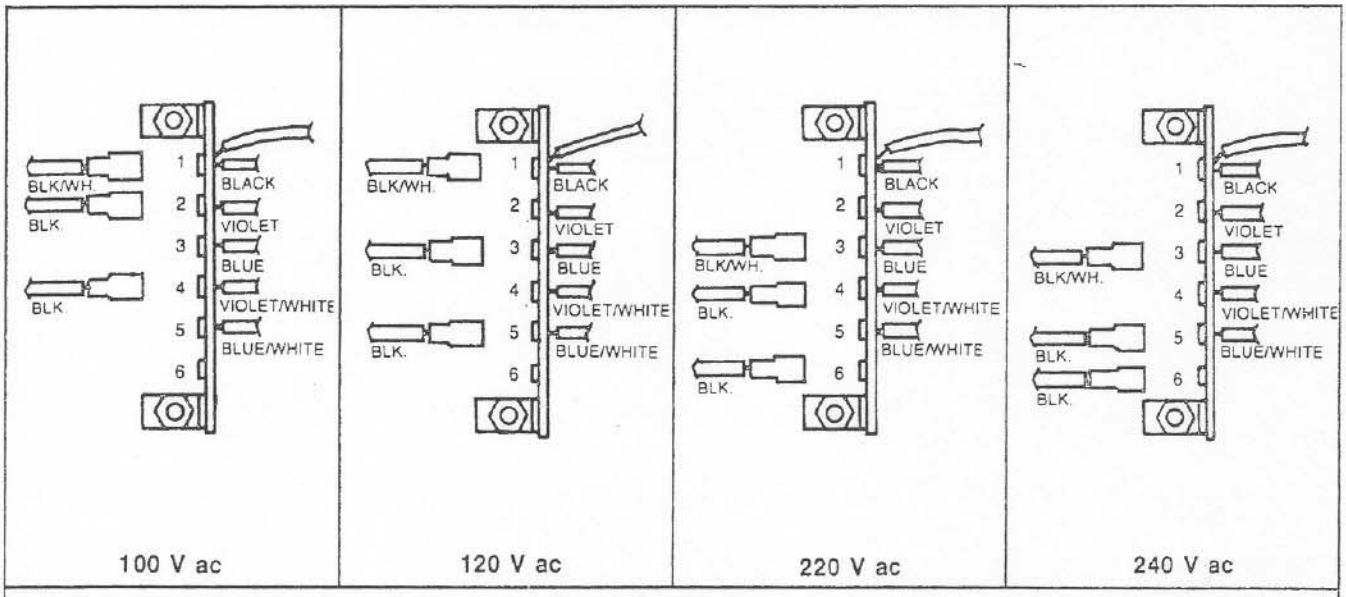


TABLE I
Primary Power Conversion Chart for 100-, 120-, 220-, and 240-V, 50/60-Hz Operation

Mounting

The DMC-2181 is one rack-space high (1¾ in.) and fits in a standard EIA 19-inch rack. To make wiring easier, mount the controller in a rack cabinet near the power amplifier(s).

Grounding

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

The interconnecting cables of line-level equipment, such as the DMC-2181, should have the shields connected at one point only. This point is usually the receiving end of the signal transmission. See Figure 8.

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

When deciding how to ground the DMC-2181 in a particular system, note the controller's input and output XLR-type connectors have pin 1 referenced through medium impedance to chassis ground. The connector handle chassis is grounded. Circuit ground ties to the chassis ground internally at one point. The input to the controller is active differential and the outputs are tranformer isolated.

Ventilation

Provide adequate ventilation 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

The system contains a security cover and two screws to protect the control setting against uninvited adjustments.

Maintenance

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