

DMC-2181X

DeltaMax™ Electronic Controller for DMS-2181 Series Low-Frequency Sound-Reinforcement Speaker System

- High passes a stereo full-range signal for dual DMC two-way, full-range controllers and provides a mono-summed output for a subwoofer power amplifier
- Fixed, optimized system equalization and signal delay for smooth, extended low-frequency response
- Active sensing broadband compressor circuit, with varying compression ratio, provides speaker thermal protection
- Active sensing speaker overexcursion protection with soft-clip limiting
- User-adjustable power amplifier clip calibration circuitry
- LED displays for each band indicate protection mode
- High current output drives many paralleled power amplifiers
- Also works with DMS-1181 series speaker systems

Description

The Electro-Voice DMC-2181X controller is part of the DeltaMax™ series of electronically controlled speaker systems intended for high-level sound reinforcement and permanent installation applications. The DMC-2181X controller is intended to be used with the DMS-2181 series low-frequency speaker systems. DMC-2181X controller can also be used with DMS-1181 series low-frequency speaker system. In addition to providing frequency division, time-offset correction, broadband equalization and high-pass filtering, the controller, when placed in the signal path before the amplifier, incorporates special speaker performance-modeling circuitry to electronically protect the transducers against overexcursion, voice-coil overheating and amplifier clipping. The result is maximum fidelity at extreme power outputs, without sacrificing reliability.

The companion DMS-2181 series speaker systems utilize two EVX-180A low-frequency reproducers, and incorporate Electro-Voice's Manifold Technology® enclosure design. This allows greater output over conventional vented boxes in a greatly reduced package size. Additionally, acoustic loading is improved, yielding increased low-fre-

quency efficiency and reduced distortion over direct-radiating and horn-loaded cabinets.

The electronic circuitry in the DMC-2181X is designed to provide optimum audio performance, even when the audio drive level is increased beyond normally safe levels for maximum loudness. A high-quality, low-noise VCA is driven by speaker performance-modeling circuitry to provide long-term temperature protection and amplifier anticlip limiting. Excursion protection is accomplished via voltage-limiting circuitry which follows excursion/frequency modeling parameters to control amplitude peaks before damage is incurred.

Front panel indicator lights show input levels, gain reduction, and low-frequency output-limit thresholds for excursion, temperature and amplifier clipping. Operation of the protection functions is completely automatic. The user-adjustable clipping-threshold calibration will work with any professional amplifier operating within the power and gain range stated in the amplifier requirements section.

Principle of Operation

Refer to block diagram in Figure 3. The signal paths consist of right and left ac-

tive differential input circuits driving two fourth-order Linkwitz-Riley crossover sections. This configuration provides high-frequency left, high-frequency right, and low-frequency adjustable outputs. The left and right highpass output signals (above 100 Hz) are unprotected and are intended to be sent to a pair of full-range DMC-controller/DML-loudspeaker systems. The right and left low-frequency signals are summed and drive a VCA (voltage controlled amplifier) section. The control voltage is derived from a single amplifier-linked sense input, modified by a dual-time-constant compressor control circuit. Following the VCA, the low-frequency signal enters a delay circuit (for proper time/phase alignment relative to other DeltaMax™ systems at crossover frequency) and a frequency-contouring equalizer to provide optimum flat response for the speaker system. Additionally, an underdamped second-order high-pass filter, combined with a variation of a first-order shelving low-boost function provides optimum low-frequency system roll-off. All three outputs are active balanced for maximum current drive. The primary dynamic action (gain reduction) of the compressor circuit is controlled by a dual-time-constant detection circuit driven by rectified audio sensed at the speaker terminals. The

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compression ratio above the threshold is determined by modeling circuits, which increases the compression ratio as required by detection of temperature, and/or amplifier-clipping limits being passed. In all modes, the compressor gain-transfer function has a gradually changing slope across its threshold. This soft-knee design reduces the audibility of the compression. The ratio above the threshold can vary from 1:1 (no effect) to approximately 20:1 (hard limiting) depending on the signal source and the type of protection called for.

A dynamic frequency-sensitive voltage limiter at the output of the low-frequency band protects the speakers from excursion damage. If the speakers approach their excursion limit, the peak of the output waveform is clamped at a level above which excursion damage would occur.

Frequency Response

The frequency response of the DMC-2181X/DMS-2181 combination shown in Figure 1 was measured on axis in the far field of an anechoic environment, using swept one-third-octave input and calculated to a one-meter equivalent distance using the inverse-square law. Drive level was set at one watt of power (2 volts rms at 70 Hz) delivered to the mid band of the low-frequency range.

Installation

Mounting/Location

The unit is one rack space high, 445 mm (1.75 in.), and fits a standard EIA 19-inch rack. Mount the DMC controller in a rack cabinet near the power amplifiers to simplify wiring. The controller is well shielded from magnetic and radio-frequency interference. It is possible to use the controller at a "house mix" location, removed from the amplifier mounting location and near the mixing board, in order to facilitate adjustment of the crossover levels and provide easy visual inspection of the LED metering. In this application, signal-return lines are needed to feed signal splits to the amplifiers. The low-source impedance will adequately drive long cable lengths. A speaker sense line must be returned to each DMC-2181X controller from the amplifier location.

Grounding

A widely accepted grounding scheme for audio systems is the star-connection (single-point) ground technique. While the final configuration will be determined by the size of the system and the equipment used, the star-connection grounding scheme is recommended as a start. Never lift the safety ground of the ac power cable, as it protects against chassis shock hazard.

Ventilation

In normal operation, the controller generates some heat. In order to keep all components in their operating range, it is recommended that the electronics be mounted with adequate flow-through ventilation front and back. Do not place amplifiers or controllers in a sealed enclosure. Leaving a single empty rack space between adjacent amplifiers and the controller, preferably vented, will provide a margin of safety for all devices. Ambient temperature inside the enclosure should never exceed 60 °C (140 °F).

Security

A security cover and mounting screws are supplied for protecting the user-adjustable controls on the front panel of the controller.

Connections

The DeltaMax™ controller has XLR-type connectors for signal input and outputs. Pin 1 is shield, pin 2 is high (+), and pin 3 is low (–). The input is active differential and the outputs are electronically balanced. When used in an unbalanced configuration, pin 3 should be shorted to ground.

The SUB sense connection is a dual-binding-post/banana jack (five-way binding post). The sense input is active differential, enabling connection to the output of mono-bridged amplifiers, and are high impedance, allowing small gauge wire (e.g., #22 AWG) to be used for the sense connection. Although current flow in the sense lines is negligible, they must be capable of handling the high output voltages of the amplifiers.

Amplifier Requirements

The DMS-2181 cabinet contains two drivers. With a 4-pin Neutrik Speakon® NL4MP-R

connector, each driver may be accessed separately. There are two ways these drivers may be wired:

1. Each driver may be connected to its own separate amplifier channel. Each amplifier channel should have a power rating of 600-1,200 watts into 8 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. The amplifier channel should have a power rating of 1,600-4,000 watts into 4 ohms.

NOTE: DMS-2181 cabinets may be paralleled (in either of the above configurations) with other DMS-2181's if the amplifier is capable of delivering adequate power at the lower impedance. The use of amplifiers with lower power ratings is acceptable; however, the DMS-2181 will not realize its full power capabilities. The use of amplifiers with significantly higher power ratings is wasteful and may endanger the loudspeakers; it is not recommended. The user is instructed to consult the DeltaMax™ owner's manual for details. The manual is included with the DMC-2181X electronic controller.

Architects' And Engineers' Specifications

The controller shall consist of two crossover circuits with fourth-order Linkwitz-Riley filters, a compression system with variable ratio and dual-time-constant detector, a voltage-clamping circuit for excursion protection, speaker-modeling circuits which control the compressor and clamp circuits to prevent destruction of the drivers due to excessive drive level. Included in the signal path shall be special frequency equalization and signal delay to provide flat (± 3 dB) on-axis anechoic frequency response in the range of 36 to 100 Hz.

The total harmonic distortion through the signal path shall be nominally 0.03% and no greater than 0.1% from 20 to 20,000 Hz, within the unit's passband. The noise at the outputs measured with a 20-20,000-Hz

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equivalent-noise-bandwidth filter shall be typically -86 dBu.

The signal inputs shall be active differential with a level capability of +18 dBu, and female XLR-type connectors. The outputs shall be electronically balanced with a level capability of +18 dBu into 600 ohms, and male 3-pin connectors. There shall be an active differential sense input for speaker protection, with binding-post/banana-jack connectors.

Front panel controls shall include sub, left and right high-level controls, a sub amplifier calibration control, and a switch to control the amplifier limit function, all accessible with a screwdriver after removing the security cover. There shall be a power switch on the front panel. Front panel indicators shall include right input level, left input level, gain reduction, output limits (for amplifier, excursion, and temperature), and power on.

The chassis shall be made of painted steel with a gray front panel and white graphics. It shall be rack mountable in a 483 mm (19 in.) EIA rack and be 44.5 mm (1.75 in.) high and 228 mm (8.97 in.) deep overall, including connectors. The unit shall weigh 3.2 kg (7 lb). The unit shall be an Electro-Voice DMC-2181X.

Uniform Limited Warranty

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 Mark IV Audio Service or any of its authorized service representatives. **Obtaining Warranty Service:** To obtain warranty service, a customer must deliver the product, prepaid, to Mark IV Audio Service 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 Mark IV Audio Service at 600 Cecil Street, Buchanan, MI 49107 (800/234-6831 or FAX 616/695-4743). **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 Electronics are guaranteed against malfunction due to defects in materials or workmanship for a period of three (3) years from the date of original purchase. Additional details are included in the Uniform Limited Warranty statement.

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 1—DMC-2181X/DMS-2181
Frequency Response (anechoic
environment 1 watt at 60 Hz, 1 meter)

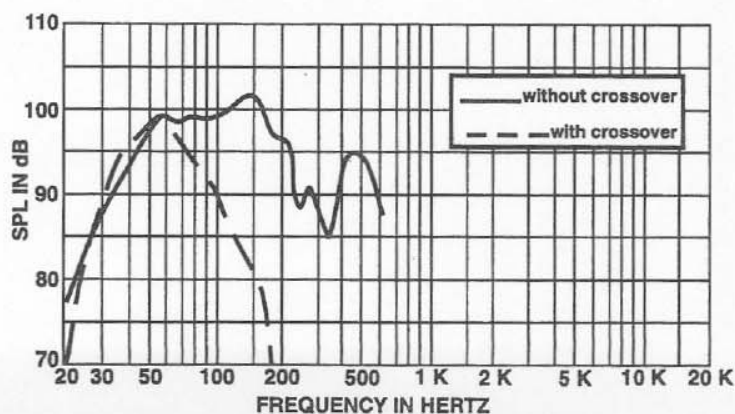


Figure 2—DMC-2181X Frequency Response

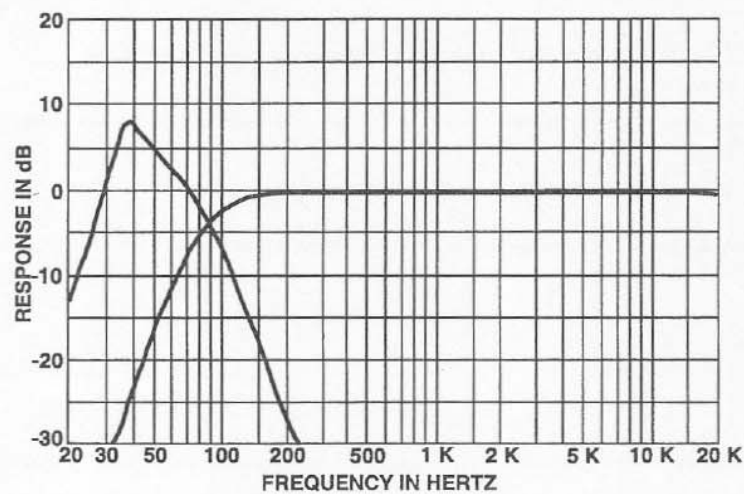


Figure 3—DMC-2181X Block Diagram

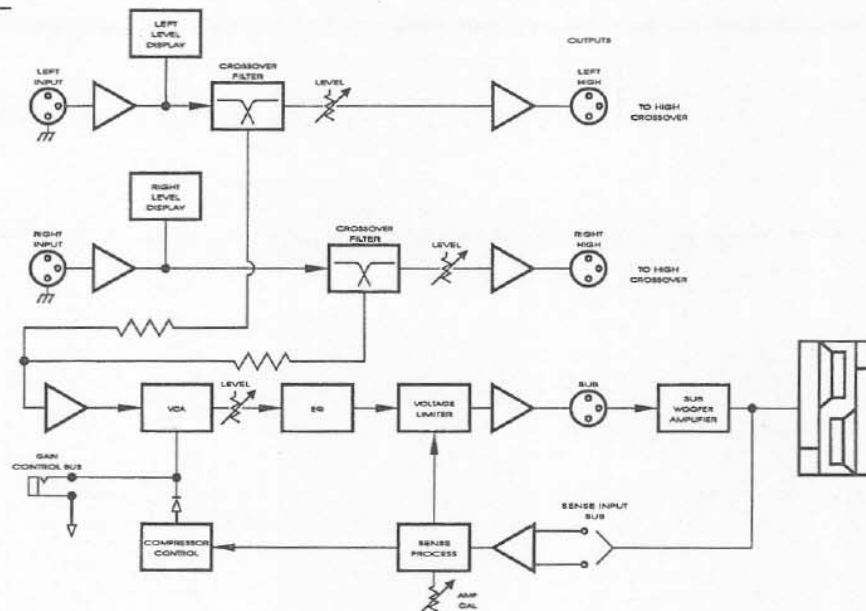
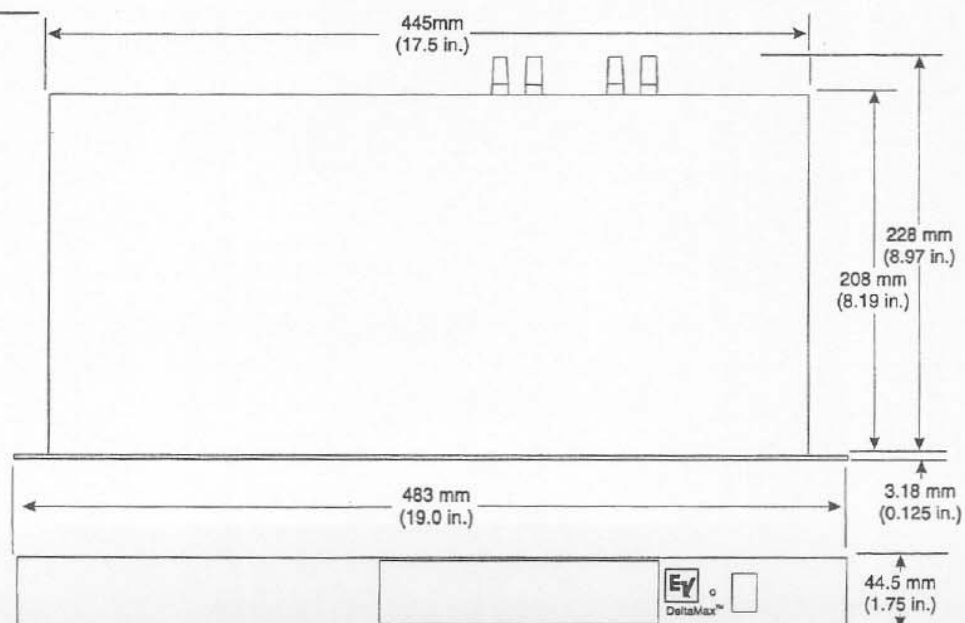


Figure 4—DMC-2181X Dimensions



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System Specifications¹

Frequency Response, DMC-2181X with DMS-2181 Series Speaker, One Watt into Sub Mid Band (2.00 volts at 60 Hz) on Axis in Anechoic Environment (see Figure 1):

36-100 Hz ± 3 dB

Controller Specifications**General Functions:**

Dual two-way crossovers; subwoofer output includes frequency and time-delay equalization, 12-dB-per-octave infrasonic filter, temperature, excursion and amplifier clipping protection

Channel Configuration:

Dual channel (stereo) two-way, one sense channel (subwoofer); high-frequency outputs unity gain above crossover frequency

Crossover Frequency:

80 Hz

Crossover Filter:

4th-order Linkwitz-Riley (24-dB-per-octave)

Gain:

+5 dB nominal, equalized sub output. Unity gain high output

Signal-Path Equalization (subwoofer section):

+3 dB at 37 Hz

-3 dB at 30.5 Hz

Signal Delay (subwoofer output):

4.0 ms at crossover frequency

Total Harmonic Distortion, 20-20,000 Hz:

0.03% typical, 0.1% maximum

Noise, Each Output, 20-20,000 Hz Bandwidth, Typical:

-86 dBu²

Signal Input,**Type:**

Active differential

Maximum Level:

+18 dBu²

Impedance:

20,000 ohms and 0.0015 μ f

Common-Mode Range:

± 24 V

CMRR, Typical:

-55 dB

Connectors:

Female 3-pin XLR-type

Signal Outputs,**Type:**

Electronically balanced

Maximum Level:

+18 dBu²

Minimum Load Impedance for Full Level:

600 ohms

Protection:

Safe for short circuit or ± 25 volts dc

Connectors:

Male 3-pin XLR-type

Sense Input (subwoofer only),**Type:**

Active differential

Maximum Level:

145 volts rms

Impedance:

200,000 ohms differential

Connector:

Binding post/banana jacks, spaced 19 mm (0.75 in.)

Controls (all except power switch are screwdriver adjustable):

Output levels, amplifier limit calibration, amplifier clip/limit switch; power on-off switch

Indicators:

Dual three-LED input level, right & left (-20, 0, and +16 dBu)

Three-LED gain reduction (3, 6, and 12 dB)

Three-LED LF output protection (temperature, excursion, clipping)

One LED power on

Power Requirements:

100, 120, or 240 volts ac, 50-60 Hz, 13 watts

Chassis Construction:

Painted steel

Color:

Gray front panel and black chassis with white graphics

Mounting and Overall Dimensions (see Figure 4):

EIA 483 mm (19 in.) rack mount, 44.5 mm (1.75 in.) high, 228 mm (8.97 in.) behind panel, including connections; supplied with front-panel security cover for controls

Net Weight:

3.2 kg (7 lb)

Shipping Weight:

4.2 kg (9 lb, 3 oz)

1. See DMS-2181 series engineering data sheets for detailed speaker system specifications.

2. 0 dBu is 0.775 volts rms sine wave.

Electro-Voice®

a MARK IV company

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SPEAKERS—MT and DeltaMax™

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