Electro-Voice®

TL880P

Very-Low-Frequency Powered Speaker System

- Digital Capable™—designed expressly to meet the dynamic and low-frequency potential of digital sound on film
- THX® approved[1]
- Side-mounted connection panel facilitates hookup when depth behind the screen is restricted
- Two EVX-180A 18-inch woofers, rated at 2,000 watts of combined continuous program power, provide very high low-frequency pumping ability to below 23 Hz
- Unusually extended LF response also appropriate for very-low-frequency synthesized effects, down-tuned bass guitars or pipe organ
- Internal, P1250 power amp delivers 1,200 watts continuous to the loudspeakers
- On-board P1250 processing provides "step-down" EQ, limiting to prevent amp clipping under high-output conditions, and infrasonic speaker protection

[1]THX is a registered trademark of Lucasfilm Ltd.

Description and Applications

The Electro-Voice TL880P is a member of the TL series of low-frequency enclosures. The TL880P is a powered subwoofer designed expressly for digital sound on film and other applications which require very high low-frequency pumping ability extending to 25 Hz and below. The TL880P features an Electro-Voice P1250 power amplifier, set up in bridge mode driving two EVX-180A 457-mm (18-in.) speakers, with a combined rating of 2,000 watts continuous program, connected in parallel. The P1250 can deliver 1,200 watts continuous (20-20,000 Hz) to the resultant 4-ohm load. The P1250 has on-board signal processing which supplies:

1. Low-frequency equalization necessary for "step-down" operation of the loudspeaker system, providing an overall system response whose 3-dB-down point (f_3) is 23 Hz.
2. Infrasonic protection of the EVX-180A-s below the P1250's peak boost frequency of 26 Hz.
3. Output limiting that prevents amplifier clipping under high-output conditions.

The side-mounted input for the amplifier facilitates behind-the-screen installation, where limited space between the screen and theatre wall often makes it difficult to connect to the back of an enclosure.

In addition to motion-picture applications, the TL880P is highly appropriate as the subwoofer in large, multiway systems for contemporary music playback and sound reinforcement. The TL880P has more output below 40 Hz than the devices typically used in these applications, in either the normal (25 Hz) or alternative (30 Hz) box tuning (see Alternative Vent Tuning and Equalization Options section). Thus, the TL880P is not only appropriate for the more typical 40-Hz-and-above subwoofer requirements, but also for those applications, e.g., very-low-frequency synthesized effects and down-tuned bass guitars, that require high output below 40 Hz. This extended low-frequency performance also plumbs the depths of the symphony orchestra and pipe organ.

Frequency Response

The TL880P's axial frequency response was measured in Electro-Voice's large anechoic chamber at a distance of 3.05 meters (10 feet) with a swept sine-wave input. Figure 1 has been averaged and corrected for 1 watt/1 meter into the transducers.

Directivity

The directional characteristics of the TL880P were measured in Electro-Voice's large anechoic chamber; the test signal was one-third-octave filtered pink noise at the frequencies indicated. A full spherical measurement system was used. All directional information was measured at 6.10 meters (20 feet).

Figure 2 illustrates the horizontal and vertical polar responses. Figure 3 shows the horizontal and vertical beamwidths. Beamwidth is the angle at which the horizontal and vertical polar responses have decreased in level by 6 dB when compared to the axial frequency response.

Figure 4 illustrates the total directivity of the TL880P. The directivity factor $R_\theta(Q)$ is the ratio of the SPL of the TL880P at a given point to the SPL of an ideal omnidirectional source at that same point. The directivity index, D_i, is calculated by $D_i = 10 \log_{10} R_\theta$.

Power Handling

Electro-Voice components and systems are manufactured to exacting standards, ensuring they will hold up, not only through the most rigorous of power tests, but also

through continued use in arduous, real-life conditions. The eight-hour EIA Loudspeaker Power Rating Full Range (ANSI/EIA RS-426-A 1980) uses a noise spectrum which mimics typical music and tests the thermal and mechanical capabilities of the components. Electro-Voice will support relevant additional standards as and when they become available. Extreme, in-house power tests, which push the performance boundaries of the woofers, are also performed and passed to ensure years of trouble-free service.

Specifically, the TL880P passes ANSI/EIA RS-426-A 1980 with the following values:

R_{SR} =	4.80 ohms (1.15 x R_E)
$P_{E(MAX)}$ =	1,200 watts
Test voltage =	75.9 volts rms,
	151.8 volts peak

The "peak" power-handling capacity of a woofer is determined by the peak test voltage amount. For the TL880P, a 151.8-volt peak test voltage translates into 4,800-watts short-term peak power-handling capacity. This is the equivalent of four times the "average" power-handling capacity, and is a peak that can be sustained for only a few milliseconds. However, this sort of short-duration peak is very typical in speech and music. Provided the amplifier can reproduce the signal accurately, without clipping, the woofer will also perform accurately and reliably, even at these levels.

Continuous program power is defined as 3 dB above (double) the continuous sine-wave power rating. The sine-wave power rating is a two-hour test performed at the minimum impedance of the system. It is included so comparisons can be made with competitive products.

Alternative Vent Tuning and Equalization Options

The TL880P uses the on-board signal processing of the P1250 amplifier to provide the required equalization for operating in the "step-down" mode. This equalization reaches a maximum of 6 dB at 26 Hz and at 12 dB per octave below this frequency (and at 24 dB per octave below 15 Hz). Overall system response is 3 dB down (f_3) at 23 Hz. (Achieving this same f_3 without equalization would require twice the enclosure volume.) The loudspeaker is shipped with its central port cover in place to provide the appropriate, 25-Hz box tuning. This configuration must be maintained for "as shipped" operation of the TL880P. The step-down mode maximizes acoustic output ability at frequencies just below 30 Hz (see Figure 1), appropriate for the TL880P's primary application as a cinema very-low-frequency subwoofer.

If it is not desired to use the TL880P in the step-down mode, eliminating the need for boost-and-cut equalization, it is necessary to remove the central port cover. This moves box tuning up to 30 Hz and also moves the system f_3 up to 30 Hz. See the P1250 Settings section for proper amplifier settings in the normal mode.

Subpassband Speaker Protection

The P1250 power amplifier provides 12-dB-per-octave infrasonic protection of the EVX-180A's below the P1250's peak-boost frequency of 26 Hz. Protection is increased to 24 dB per octave below 15 Hz.

P1250 Settings

The TL880P is shipped with the P1250 rear-panel processor settings set for step-down mode. See Figure 6. The speakers are connected to the central, bridged output. In the event that the rear-panel settings are disturbed, the proper settings are noted below. The rear panel of the P1250 is easily accessible through the access/vent opening in the speaker enclosure side closest to the top of the amplifier:

Step-Down Mode Settings (as shipped):

1. Limiter Time Constant switch: Slow.
2. Processor switch: B6.
3. Pole Frequency switch: 26.
4. Bridged Mode switch: Bridged.
5. Hi-Low-Cut Filter switch: 15.

Normal Mode Settings:

1. Limiter Time Constant switch: Slow.
2. Processor switch: Off.
3. Pole Frequency switch: N/A
4. Bridged Mode switch: Bridged.
5. Hi-Low-Cut Filter switch: 31 Hz.

Use in Multiples

Cone loudspeakers may be stacked for greater acoustic output and a narrower beamwidth. (It is assumed that all cones are operating in unison or "in phase.") This principle is already employed in the dual-woofer TL880P, and is responsible for the higher sensitivity and narrower vertical beamwidth (with the system long axis vertical) relative to similar single-woofer systems. In addition, two TL880P's can be used side-by-side and their combined performance will be different from that of a single TL880P in the ways outlined below.

At relatively low frequencies, below about 150 Hz for typical TL series dimensions, stacking produces additional acoustic output without altering dispersion. When a common signal is applied, a 6-dB increase in maximum acoustic output occurs. The cones "mutually couple" and act as one cone with twice the area (therefore twice the efficiency) and twice the power capacity. The additional cone area provides 3 dB more output and the additional power capacity accounts for the remaining 3 dB.

Specifically, mutual coupling occurs at frequencies whose wavelengths are longer that one-quarter the center-to-center distance between the cones. The highest frequency at which mutual coupling occurs is calculated from the following equation:

$$f \cong \frac{3{,}000}{D_{MAX}},$$

where D_{MAX} (inches) is the distance between the cones, and f (Hz) is the highest frequency at which coupling occurs. When D_{MAX} is greater than one-quarter wavelength, which would occur if two TL880P's were widely spaced, or at frequencies much above f even when closely spaced, the increase in acoustic output is limited to the 3-dB power-handling increase.

Service

In the unlikely event the TL880P requires service, the woofer can be replaced or serviced from the front and the amplifier can be replaced or serviced from the top. A service data sheet is available from Electro-Voice.

Installation and Suspension of TL880P Enclosures

The TL880P is designed for typical cinema stage (behind-the-screen) applications where subwoofers are mounted on the stage floor. In addition to the following specific information, the user may refer to the P1250 owner's manual.

The TL880P is not designed to be self-suspended from above, and if suspended, must be supported and hung in a way which does not depend on the structure of the TL880P itself for support.

Overall System Installation

Precautions

Please read the entire engineering data sheet before connecting the TL880P to your system. For optimum performance, observe the following precautions:

1. Keep the ac power switch off while making connections.
2. Be certain that connectors are tightly mated. Loose connections cause hum, noise or intermittences that could damage your speakers.
3. Use the proper, high-quality shielded cables in your entire system. Low-capacitance cable is preferred.
4. Turn on the electronic equipment which feeds the TL880P first. Wait eight to ten seconds, then turn on the P1250 amplifier. This prevents any transient "pop" which could damage a loudspeaker.
5. To prevent fire or electrical shock, do not expose the TL880P to rain or excess moisture.

Driving Multiple TL880P's

The high, 20,000-ohm input impedance of the P1250 power amplifier allows several TL880P systems to be connected in parallel (daisy chained) to the usual single signal source, without undesirable loading effects on the source. Extra connectors on the P1250 facilitate such daisy chaining.

Signal Input and Polarity Convention

The P1250 channel A input connector should be used. It is easily accessible through the access/vent opening in the speaker enclosure side closest to the top of the amplifier. The connector is a three-pin female connector, pin 2 hot. The TL880P does not invert polarity, i.e., a positive voltage on pin 2 of the P1250's input connector produces a positive (outward) movement of the loudspeaker cones. This relationship is important under some installation conditions.

P1250 Input Attenuator Settings

In the factory bridged mono mode, only the channel A input attenuator is operative. During system set up, the attenuator should be set in the full-counterclockwise "off" position, in order to avoid inadvertent and possibly excessive output from the TL880P. When the TL880P is first operated under signal conditions, the attenuator should be advanced only slightly to check for signal integrity (the P1250's front-panel channel A green input LED helps in this regard). Once proper system operation is confirmed, the control may be advanced to a point that provides, in conjunction with the chosen drive level from upstream equipment, the desired acoustic output level in the room.

System Physical Orientation and Placement

Any orientation of the TL880P is acceptable, as long as the air flow through the power amplifier is not impeded. A minimum clearance of 76 mm (3 in.) should be maintained.

Architects' and Engineers' Specifications

The loudspeaker system shall be an amplified, dual-low-frequency, bass-reflex design. Two 18-inch woofers shall be front mounted in a 414-liter (14.6-ft^3) enclosure. The system shall meet the following criteria: The loudspeaker shall be capable of handling a total of 1,200 watts long-term average with a 6-dB crest factor per ANSI/EIA RS-426-A 1980. The system shall reproduce frequencies to below 23 Hz at a usable level when used in "step-down" mode with the supplied port cover in place. The combined sensitivity of the loudspeakers shall be 98 dB at one watt, one meter (100 to 800 Hz). The enclosure shall be constructed of black texture painted plywood containing sound-absorbing glass wool. The amplifier shall be side mounted and contain the necessary circuitry to provide all the equalization and protection needed to operate the system in step down mode. The system, with minor modification, can be used as a conventional vented box and amplifier. The enclosure dimensions shall be 47.5 in. x 30.0 in. x 23.8 in. (1.21 m x 0.76 m x 0.60 m) (hwd) . Net weight shall be 89.6 kg (197.5 lb)

The very-low-frequency system shall be the Electro-Voice TL880P.

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 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 active electronics associated with the speaker systems are guaranteed for three (3) years from the date of original purchase. Additional details are included in the Uniform Limited Warranty statement.

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.

Electro-Voice Accessories are 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.

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.

Figure 1—TL880P Axial Frequency Response 1 watt/1 meter into transducers

"Alternate Tuning" no vent cover ———

"Normal Tuning" with built in EQ — — — —

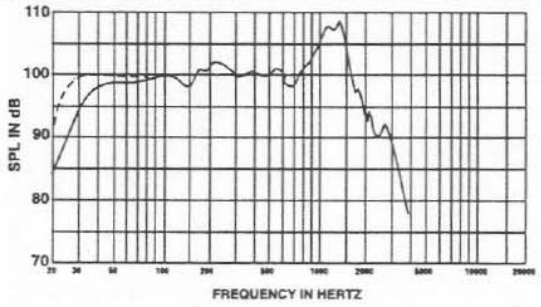


Figure 2—TL880P Polars

Horizontal ———
Vertical — — — —

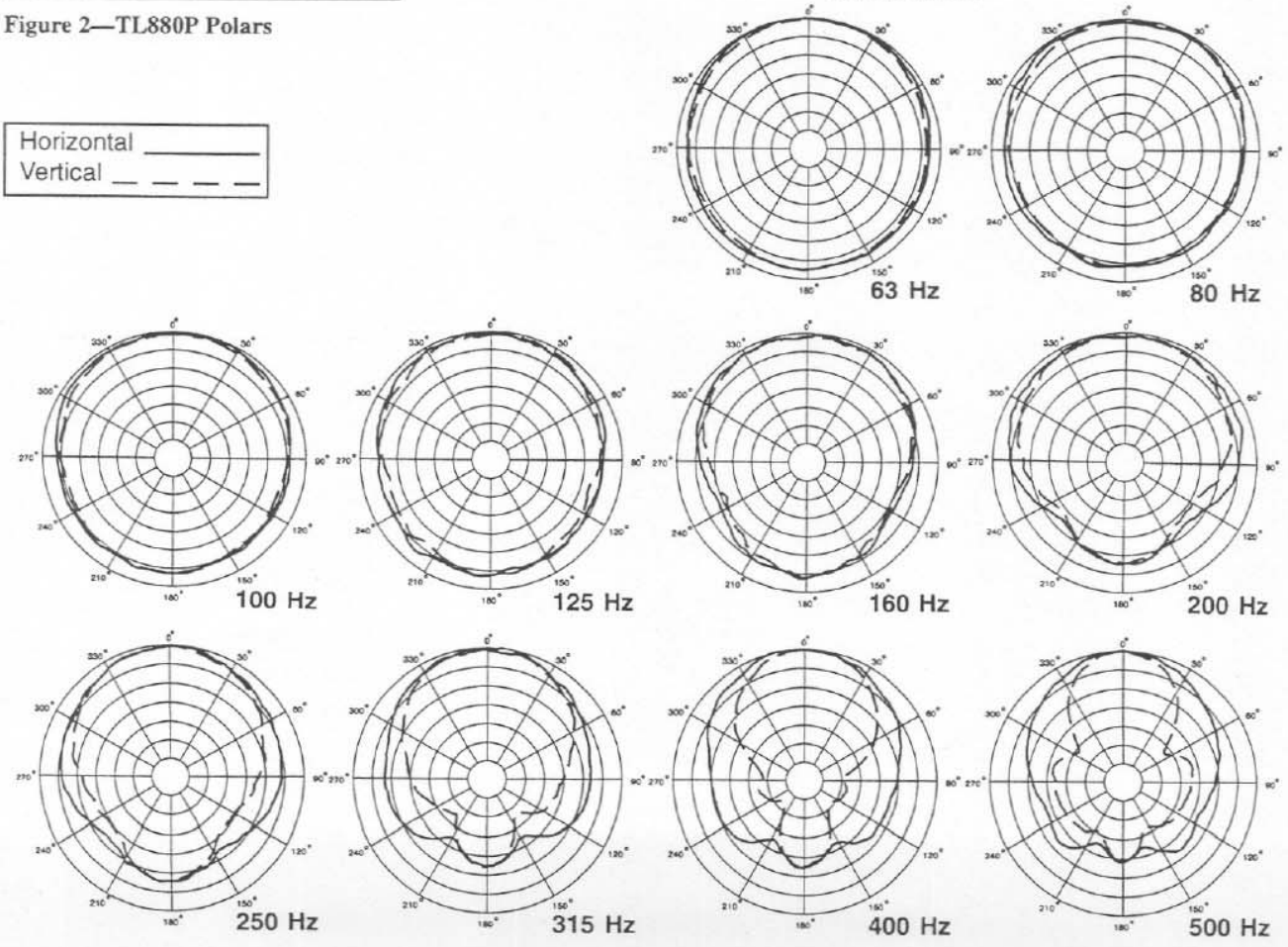
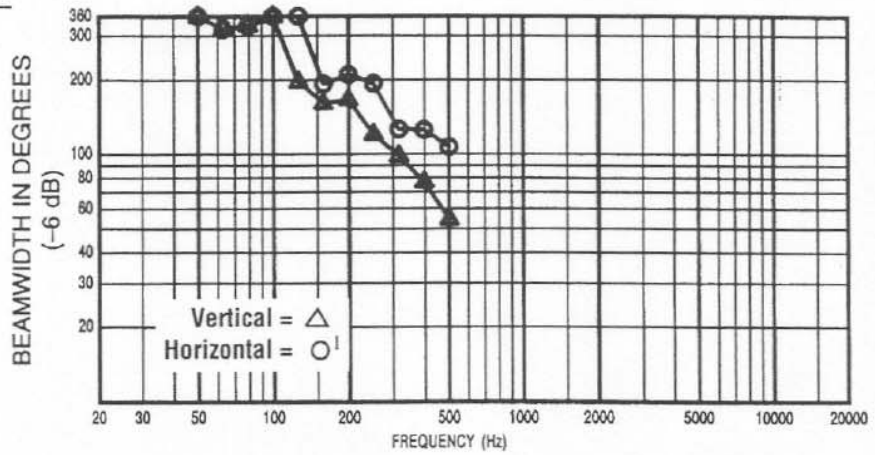


Figure 3—TL880P Beamwidth vs. Frequency



1. Woofers Horizontal

Figure 4—TL880P Directivity vs. Frequency

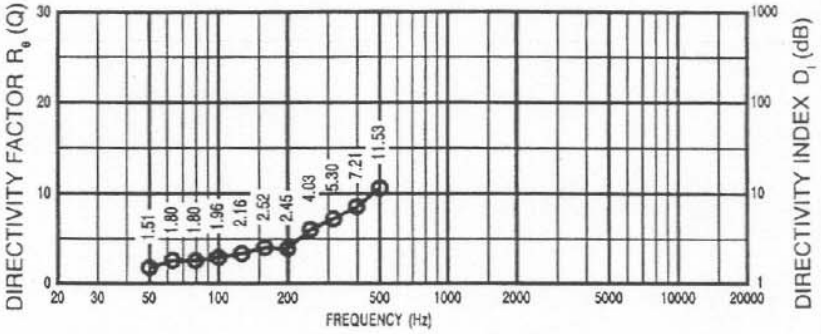


Figure 5—TL880P 10% Power Harmonic Distortion Step-Down with EQ

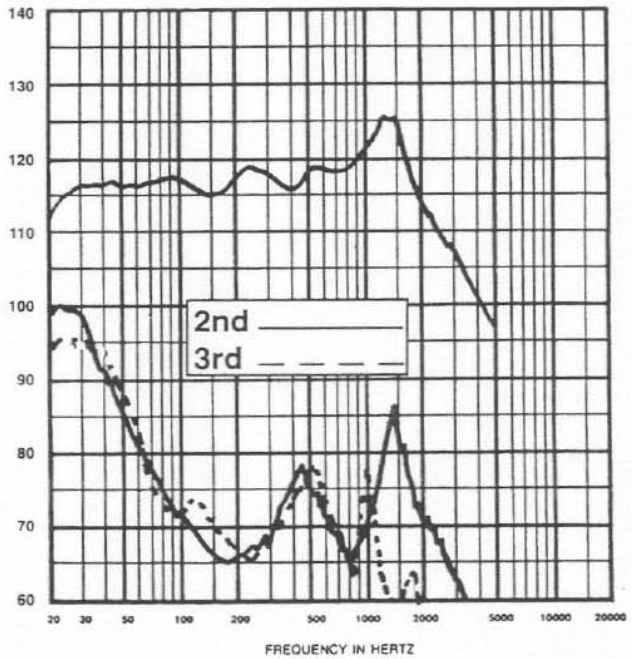
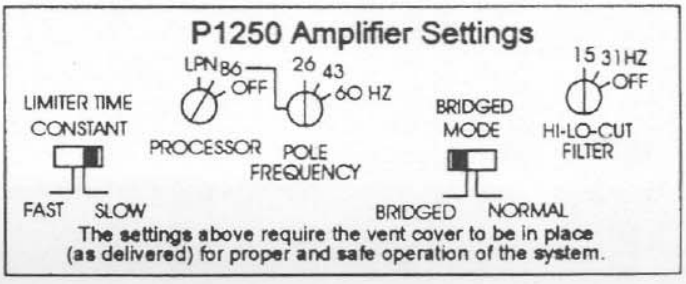


Figure 6—TL880P Amp Settings for Step-Down Operation (as shipped)



TL880P Very-Low-Frequency Powered Speaker System

System Specifications

Typical Axial Frequency Response (swept sine-wave input, 10 feet, anechoic environment, normalized for 1 watt, 1 meter into speakers; see Figure 1):
23-1,800 Hz

Low-Frequency 3-dB-Down Point,
Normal Tuning (vent cover installed for step-down mode, with equalization):
23 Hz
Alternate Tuning (vent cover removed, no equalization):
30 Hz

Usable Low-Frequency Limit (10-dB down point),
Normal Tuning (vent cover installed for step-down mode, with equalization):
20 Hz
Normal Tuning (vent cover installed for step-down mode, no equalization):
18 Hz
Alternate Tuning (vent cover removed, no equalization):
27 Hz

Sound Pressure Level at 1 Meter, Maximum Gain and Amplifier at Clipping Threshold, 0 dBu (0.775 volts rms) into Balanced Input, Anechoic Environment, Swept Sine Wave,
100- to 800-Hz Average:
129 dB
50- to 125-Hz Average:
127 dB

Half-Space Reference Efficiency (transducers):
6.0%

Maximum Long-Term Average Mid-Band Acoustic Output:
72 watts

Dispersion Angle Included by 6-dB-Down Points on Polar Responses (see Figure 3):
Essentially omnidirectional in subwoofer range, more directive above

System Distortion, 0.1 Full Power Output,
Second Harmonic (see Figure 5),
100 Hz:
0.9%
Third Harmonic,
100 Hz:
0.4%

Transducer Complement:
Two EVX-180A

Transducer Impedance (nominal/minimum):
4.0/4.2 ohms

Net Box Volume:
414 liters (14.6 ft^3)

Box Tuning Frequency,
Normal Tuning (vent cover installed for step-down mode):
26 Hz (as shipped)
Alternate Tuning (vent cover removed):
30 Hz

Step-Down Peak-Boost Frequency (see Alternative Vent Tuning and Equalization Options section):
26 Hz (as shipped)

Hi-Low-Cut Filter,
Frequency:
15 Hz (as shipped)
Slope:
12 dB (as shipped)

Enclosure Materials and Colors:
Black texture-painted poplar plywood

Amplifier Safety Approvals (in progress):
UL-813; CSA-C22.2; IEC-65 (ENG-0065); EMC Directive for European RFI/EMI emissions

Dimensions,
Height:
1.21 m (47.5 in.)
Width:
762 mm (30.0 in.)
Depth:
605 mm (23.8 in.)

Net Weight:
89.6 kg (197.5 lb)

Shipping Weight:
97.6 kg (215.3 lb)

Amplifier (see P1250 documentation for full specification)

System Output Power, Continuous (4-ohm load, bridged, 100- to 130-volt ac line voltage):
1,200 watts

Power Bandwidth as Used in Bridged Mode (+0 to –1 dB, reference 1 kHz):
20-20,000 Hz

Frequency Response (–1 dB, reference 1 kHz/1 watt):
10-30,000 Hz

Total Harmonic Distortion Plus Noise at 1 kHz (at rated power, measurement bandwidth 80 kHz):
<0.01%

Input,
Type:
True balanced, electronic
Connector:
3-pin female XLR-type connector wired according to the IEC 268 standard: pin 1 shield, pin 2 positive, pin 3 negative
Polarity (for positive sound pressure):
Pin 2 positive
Sensitivity (for 1,200-watt, unclipped output), System Gain Control Full Clockwise:
0 dBu (0.775 volts)
Impedance:
20 kilohms

Controls and Switches, Rear (see Figure 6 and P1250 Settings section for default settings):
Limiter time constant; processor; pole frequency; bridged mode switch; hi-lo-cut filter; input routing, parallel or dual; circuit-to-chassis switch, parallel or dual

Front:
Power on-off switch; indicator LED's; two calibrated input level controls

Power Consumption (both channels operating in dual mode, 1/8 power),
4 Ohms:
660 VA
Input Voltage:
120 V, 50-60 Hz ac
Tolerance of mains voltage:
± 10%
ac Line Cord:
14-gauge, three-wire, permanently attached power cable

Electro-Voice®
a MARK IV company
600 Cecil Street, Buchanan, MI 49107
800/234-6831, 616/695-6831, 616/695-1304 Fax

Part Number 533431-9623