

402 LOUDSPEAKER

402-W LOUDSPEAKER

402-E ACTIVE EQUALIZER **

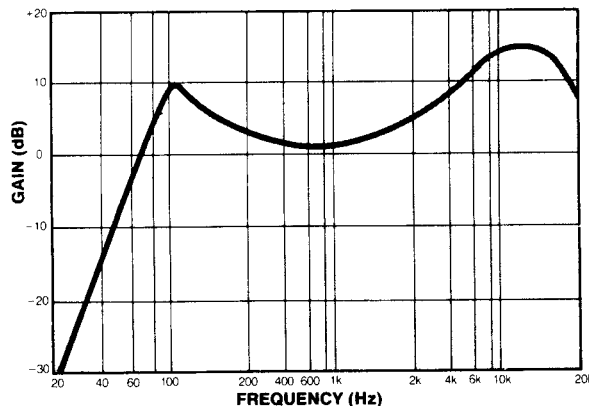
SPECIFICATIONS

402 AND 402-W LOUDSPEAKERS

Transducer Complement:	Four (4) 4½" (11.4 cm) BOSE® D-22A high-sensitivity drivers.
Nominal Impedance:	8 ohms
Sensitivity:	98 dB SPL (1 watt, 1 m, 300 Hz - 3 kHz)
(Single Speaker)	93 dB SPL (1 watt, 1 m, 90 Hz - 16 kHz)
Usable Frequency Range:	90 Hz to 16 kHz
Power Handling:	120 watts continuous pink noise, 90 Hz - 16 kHz. 160 watts (rms) maximum recommended amplifier size.
Horizontal Beamwidth:	120°
Vertical Beamwidth:	60°
Input Connections:	<u>402</u> : Two (2) parallel-wired ¼" (6.3 mm) phone jacks. <u>402-W</u> : Rear-panel barrier-strip screw terminals.
Fusing:	<u>402</u> : Replaceable 3-ampere, quick-acting fuse. <u>402-W</u> : External 3-ampere, quick-acting fuse recommended in most applications.
Enclosure Construction:	<u>402</u> : Mica-reinforced polyethylene copolymer structural foam. <u>402-W</u> : Acrylic-coated walnut-grain vinyl laminate on particle board.
Dimensions:	<u>402</u> : 23 1/4" H x 8 1/8" W x 7 1/4" D (59 x 21 x 18 cm) <u>402-W</u> : 22" H x 7 3/4" W x 7 1/2" D (56 x 20 x 19 cm)
Weight:	<u>402</u> : 16 lbs. (7.27 kg) <u>402-W</u> : 17 lbs. (7.23 kg)

402-E ACTIVE EQUALIZER

Input Connections:	One (1) high-Z unbalanced ¼" (6.3 mm) phone jack.
Input Impedance:	Greater than 1 megohm.
Output Connections:	One (1) ¼" (6.3 mm) phone jack.
Gain:	+8.5 dB @ 100 Hz 0 dB @ 750 Hz +13.5 dB @ 13 kHz
Harmonic Distortion:	Less than 0.5% THD at 5-Volts output at 1 kHz in 10 K ohm load. (.15% THD typical)
Signal To Noise:	Greater than 80dB CCIR weighted, reference 1-volt RMS output.
Output Level:	6 volts into 10 k ohms or higher. 3 volts into 600 ohms.
Power Requirements:	110 Vac, 50-60 Hz, 3 watts 220 Vac, 50-60 Hz (not available in USA) 100 Vac, 50-60 Hz (Japan only)
Dimensions:	1 7/8" H x 5 1/2" W x 6 3/4" D (4.8 x 14 x 17.2 cm)
Weight:	1 lb (0.5 kg)



402-E Active Equalizer gain characteristics.

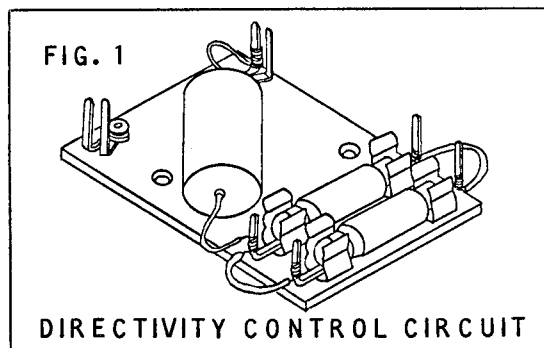
** NOTE: All information in this manual on the 402-E Equalizer pertains to the original version that was used mostly in portable applications. (1½" H x 5½" W). Information on the newer 402-C System Controller with additional voice input, used solely in installed systems, can be found in manual supplement, BOSE P/N 132129.

TECHNICAL DESCRIPTION

The BOSE^R 402 and 402-W systems are equalized loudspeakers designed for high-quality reinforcement of voices and acoustic instruments. The 402 speaker is ideal for applications requiring a rugged, portable enclosure, while the 402-W speaker is intended for use in permanent indoor sound system installations. The acoustic properties of the 402 and 402-W systems are identical.

Both speakers employ four (4) 4½" (11.4 cm) BOSE^R D-22A high-sensitivity drivers, mounted vertically on a faceted Articulated ArrayTM baffle assembly. The drivers feature low-impedance edge-wound aluminum voice coils, 12-ounce Ferrite V ceramic magnets, molded polyester frames and an advanced cone and motor system for high linear excursion capability and power output.

Tuned Reactive Radiator slots reduce distortion by controlling the cone excursion required to reproduce mid-bass frequencies. An Acoustic Diffractor (see 2 on 402 or 3 on 402-W parts list) broadens and smooths the horizontal radiation pattern of the inner drivers for more uniform side-to-side room coverage. A built-in Directivity Control circuit (see Fig. 1) maintains the vertical dispersion pattern through the high-frequency range and also protects the drivers from the effects of high-frequency overload.



The 402 speaker enclosure is composed of polyethylene copolymer structural foam, reinforced with 10% mica for improved durability and impact strength. The weather-resistant design of the D-22A drivers allows the 402 system to be permanently mounted outdoors in a wide variety of climates without damage. The Reactive Radiator slots provide effective enclosure drainage.

The 402-W speaker enclosure is an acrylic-coated, walnut-grained vinyl finish that can be painted to match special color requirements. The complete 402-W baffle assembly can be easily removed from the wood cabinet to facilitate the installation of mounting hardware.

The fixed 402-E Active Equalizer assures smooth, accurate spectral response across the entire operating range of the system. Sharp subsonic and ultrasonic band-limiting filters reduce power waste, stage noise, high-frequency instability and interference (see the response curve in Specification Section of this manual). Two independent signal channels are provided in a compact unit that fits into two spaces of a standard 19" equipment rack with the optional R MK-4 Rack Mount Kit.

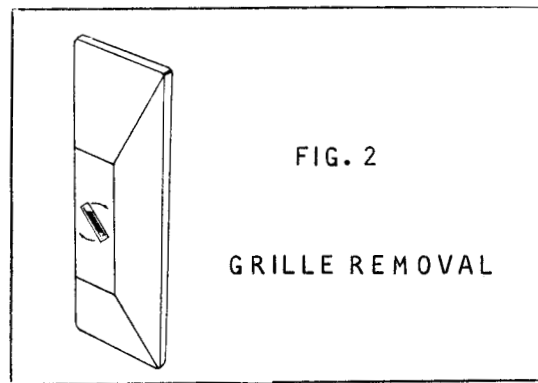
402 AND 402-W LOUDSPEAKER TEST PROCEDURE

GRILLE REMOVAL:

For ease of determining problem areas of the 402 and 402-W loudspeaker, it is recommended that the grille be removed for testing purposes. The grille is easily removed by rotating the BOSE^R nameplate 45 degrees (to the 10 or 2 o'clock position) until a release in pressure on the nameplate is felt (see Fig. 2). Carefully lift the grille off the speaker with your fingers and set it aside.

AUDIO SIGNAL TEST:

Connect a sine wave oscillator to a power amplifier. Adjust the frequency of the oscillator to approximately 25 Hz. Adjust the amplifier output to 15 volts rms and connect to the speaker input. No extraneous noises such as rubbing, scraping, or ticking should be heard, other than normal suspension sounds. Sweep the oscillator from 25 Hz to 15 kHz, assuring that there are no extraneous noises present.



402 AND 402W TROUBLE-SHOOTING GUIDE

SYMPTOM

1. No sound
2. Drivers 2 and 3 function only
3. Crackling noises

DEFECT

Open Fuse (402 ONLY)
Driver 2 or 3 open (see Fig. 3)

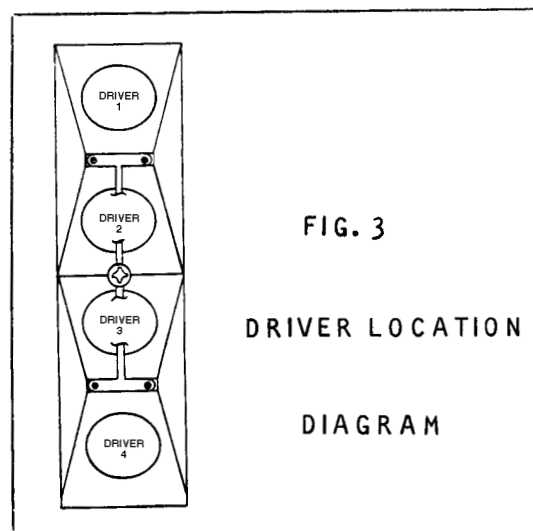
Driver 1 or 4 open (see Fig. 3)

Defective lamp on Directivity Control (see Fig. 1)

NOTE: The Directivity Control Circuit effects the dispersion pattern of the 402 and 402-W speakers. If a speaker is brought in for any complaint, the lamps on this circuit MUST be checked to assure proper operation of the speaker. (See individual 402 or 402-W repair section for specific location of the Directivity Control on the speaker you are working on.)

DRIVER LOCATION

Knowing the location of the four drivers in the 402 and 402-W loudspeakers will aid in trouble-shooting the speaker (see above chart). To find the driver location, set the speaker upright in reference to the input terminals. With the print on the Terminal section reading correctly (not upside down), the driver location is shown in Figure 3.



402 LOUDSPEAKER DRIVER TEST AND REPLACEMENT PROCEDURES

This procedure is an aid to find actual component failure after the audible test procedure has been performed.

1. Remove grille as described in Test Procedure section of this manual.
2. Remove the four (4) screws securing the Acoustic Diffractor in place (see 2 in parts drawing) and set the Diffractor aside.
3. Remove the three (3) screws from the suspected driver and set aside.
4. Lift driver out of Articulated ArrayTM. DO NOT remove wires from the driver at this time. If the suspected driver is #1, (402 ONLY) also perform Directivity Control Check at this time.
5. Take an ohmmeter (such as a Triplet) and set to the 1-ohm scale. Place meter leads across the plus (+) and minus (-) terminals of the driver to see if the cone deflects. If the driver does not deflect, the voice coil is open and the driver must be replaced. If the driver does deflect, it is good and should be reinstalled and the next suspected driver be removed by the same procedure.

NOTE: This test identifies open drivers. If the driver is making rubbing and ticking noises during audible testing, replace the driver.

6. Cut the wires connected to the driver as close to the driver terminals as possible. Take note as to which wire is connected to the positive terminal of the driver. If there is any question, refer to the schematic diagram for proper color codes.

7. Strip the wires and reconnect to the replacement driver.

8. Align the driver and gasket to the j-clips and secure the driver with the three (3) screws.

9. Perform audible test to assure repair, then proceed to Directivity Control check which must be performed on any speaker in for repair.

402 LOUDSPEAKER DIRECTIVITY CONTROL CHECK

NOTE: This test should be performed on all 402 speakers when brought in for repair. The Directivity Control effects the dispersion pattern of the speaker.

1. Locate driver #1 (See Driver Location Drawing Fig. 3) and perform steps 1 thru 4 of Driver Test and Replacement procedure.
2. Lift acoustic foam up and back to expose Directivity Control. (See Fig. 4 for location of circuit).
3. Remove lamps for continuity testing. Each lamp should read 1.5 ohms. If either bulb does not read this rating, replace the bulb.

NOTE: The lamps are wired and parallel and must be removed for proper testing.

4. Reinstall lamps and return acoustic foam to original position.
5. Align the driver and gasket to the j-clips and secure the driver with the three (3) screws.
6. Replace the Diffractor and secure with the four (4) screws.
7. Remount grille.

402 DIRECTIVITY CONTROL LOCATION

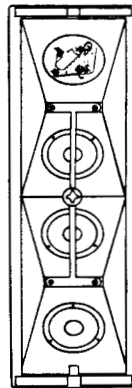


FIG. 4

402 SCHEMATIC DIAGRAM

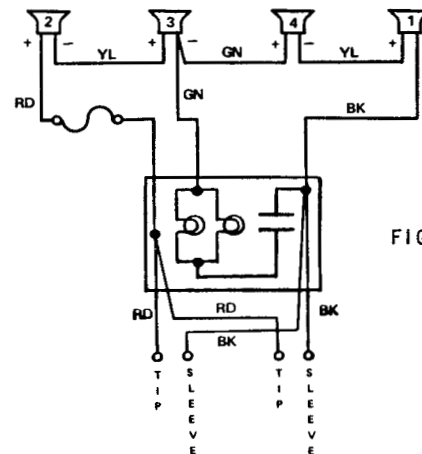


FIG. 5

402 INPUT PLATE PARTS DIAGRAM

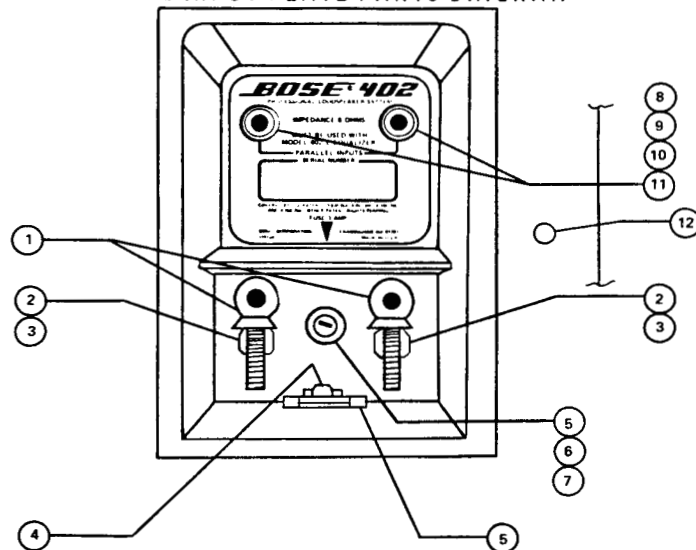


FIG. 6

402 LOUDSPEAKER INPUT PLATE PARTS LIST

Description	Part Number	Description	Part Number
1. Thumb Screw M8	137050	7. Fuse Cap	109484
2. Clip - 4 AG	121112	8. Phone Jack	102640
3. Screw #6 x .5L	103120-08	9. Lock Washer	103294
4. Spring Clip	110167	10. Nut (supplied with Item 8)	100412-14
5. Fuse 3 AG	104715-300	11. Flat Washer	110999
6. Fuse Holder	109485	12. Pan Head Nut	129814
		— Acoustic Batting (Not shown)	120357

402 LOUDSPEAKER PARTS LIST

Description	Part Number
1. Screw #6 x .5L	124773-08
2. Deflector	126973-1
3. Driver	111111-5
- Gasket	121111
3A. Screw #8 x .75L	103126-12
4. Clips, J-Type	109481
5. Grille	116882-1
6. Logo Assembly	117952-1
7. Logo Retainer	119138
- Threaded Rod	119005
- Rubber Bumper	119006

402 DIRECTIVITY CONTROL PARTS DIAGRAM

402 DIRECTIVITY CONTROL PARTS LIST

Description	Part Number
1. Cap 20 uF 10% 75u	119026
2. Lamp	109211
3. Fuse Clip	121112

SINGLE CARTON 402 KIT

Description	Part Number	Description	Part Number
Literature Kit	118670	Top/Bottom Filler	119335
Carton	119131	Sleeve	119334
Owner's Guide	119014	Poly Bag	106595

402 SYSTEM CARTON KIT

Literature Kit	118670	Bottom Filler	120780
Carton	119195	Top Cap	120781
		Poly Bag	110035

402W LOUDSPEAKER DRIVER TEST AND REPLACEMENT PROCEDURES

This procedure is an aid to find actual component failure after the audible test procedure has been performed.

1. Follow steps 1 thru 9 in 402 section, then proceed with Directivity Control Check as outlined below.

402W LOUDSPEAKER DIRECTIVITY CONTROL CHECK

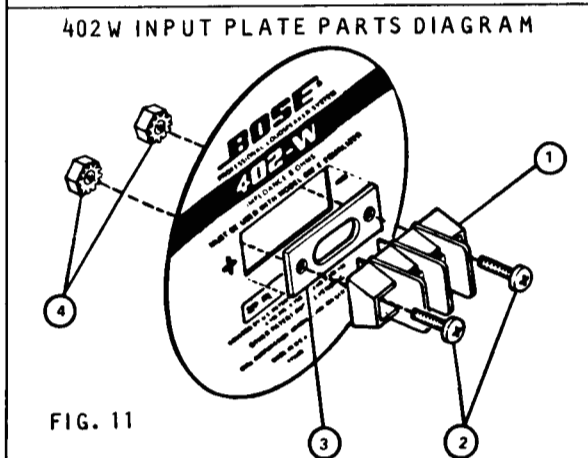
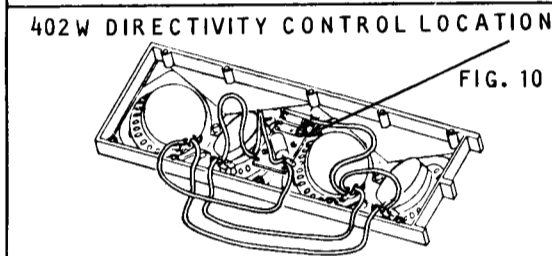
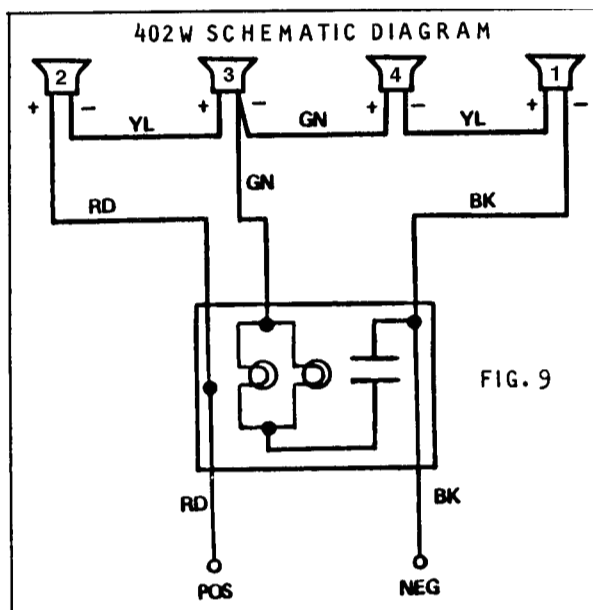
NOTE: This test should be performed on all 402W speakers when brought in for repair. The Directivity Control effects the dispersion pattern of the speaker.

NOTE: To perform this test on the 402W loudspeaker, it is best to lift the Articulated Array™ out of the speaker cabinet. (See Fig. 10 for location of the Directivity Control circuit).

1. Remove grille as described in Test Procedure section of this manual.
2. Loosen completely (but do not remove) the ten (10) captive retaining screws that hold the Articulated Array™ in place.
3. Grasp the array by the Reactive Radiator slot at one end of the array and lift the entire assembly out of the enclosure. Do NOT pull on the wires.
4. Locate the Directivity Control circuit and remove the lamps for continuity testing. Each lamp should read 1.5 ohms. If either bulb does not read this rating, replace the bulb.

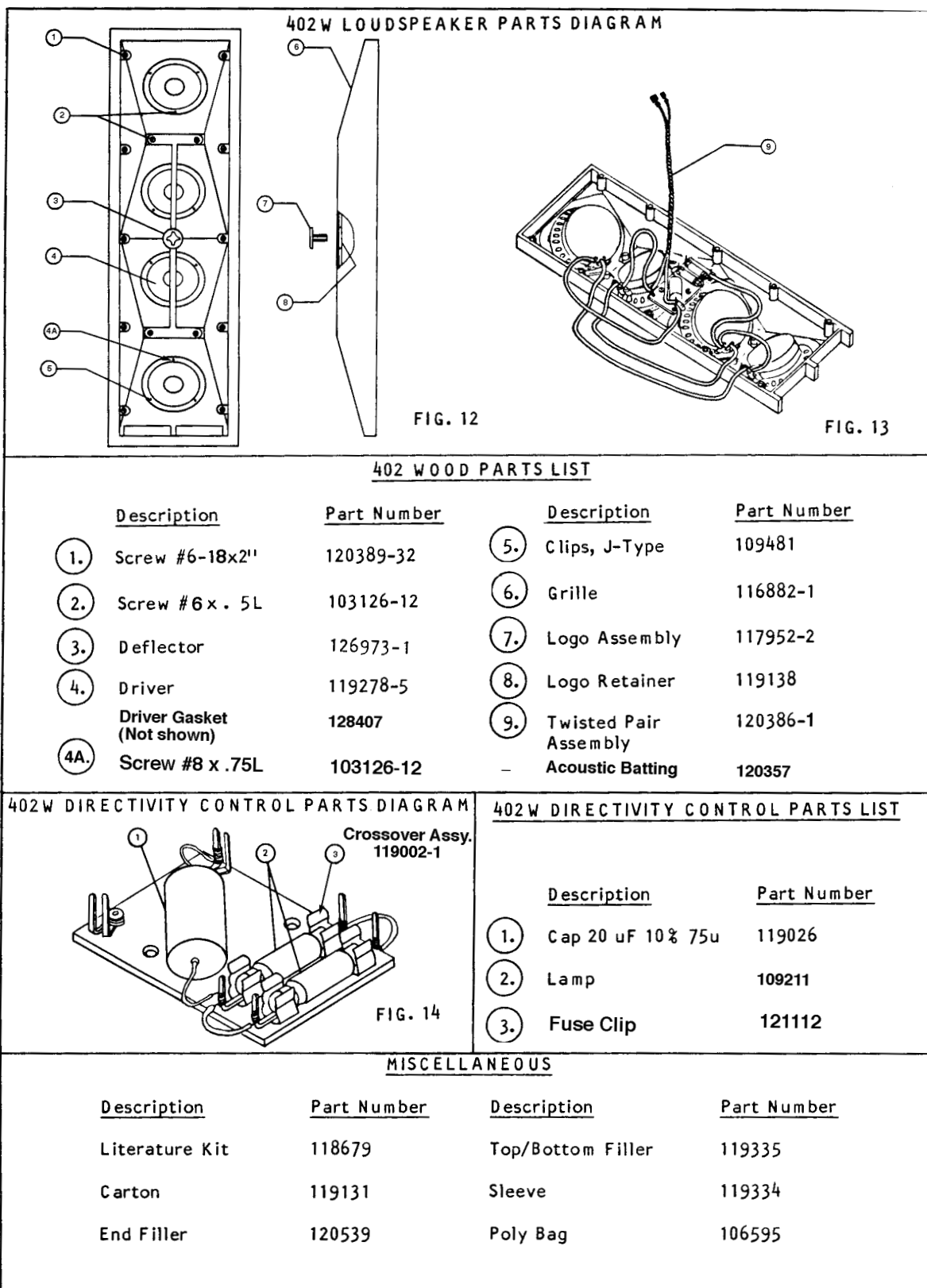
NOTE: The lamps must be removed for proper testing.

5. Install lamps, remount array to cabinet, and secure the ten (10) retaining screws. Do NOT overtighten.
6. Remount grille.



402 WOOD INPUT PLATE PARTS LIST

	Description	Part Number
1.	Terminal Strip	130133
2.	Screw	103150-12
3.	Gasket	131075-A2
4.	Kepnut #6	100413-3



402E EQUALIZER TEST PROCEDURE

1. Apply a 1 kHz sine wave signal to the inputs of the active equalizer and adjust the output of the oscillator until the output of the equalizer reaches 1-volt into a 10k ohm load. Use this as a reference level.

2. With the output voltage of the oscillator constant, adjust the frequency of the oscillator to the following points for frequency response checks:

30 Hz:	-23.5dB	+ 3dB
100 Hz:	+8.4dB	+ 1dB
10 kHz:	+13dB	+ 1dB
20 kHz:	+12.3db	+ 3dB

3. Return oscillator to 1 kHz and increase output until the output of the equalizer reaches 5-Volts into a 10 k ohm load. Measure distortion at this point, which should read less than 0.5% THD. (.15% typical)

DISASSEMBLY PROCEDURE

1. Using a Phillips-head screwdriver, locate and remove the four screws (2 on the top the cover, and 2 located on the bottom cover) holding the covers in place (see Fig. 15).

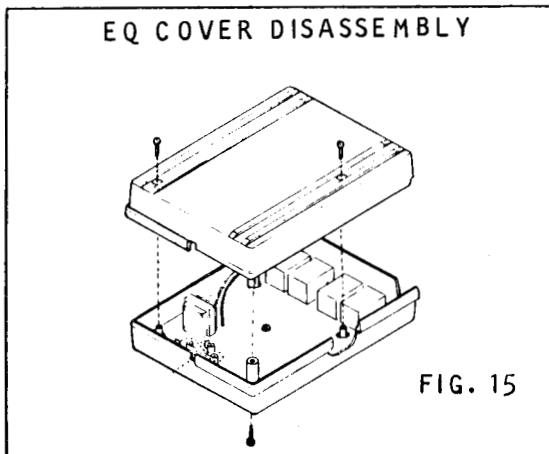


FIG. 15

2. Lift the top off of the equalizer.

3. Remove the five screws and washers holding the printed circuit board in place (see Fig. 16)

EQ CIRCUIT BOARD DISASSEMBLY

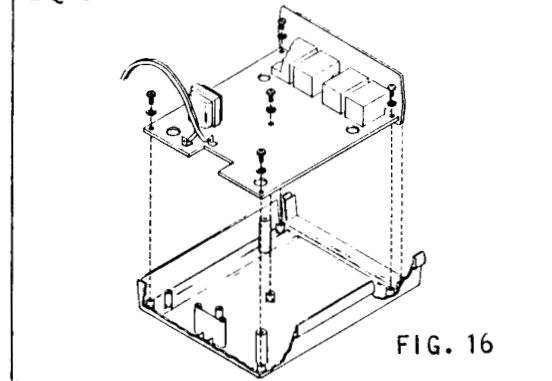


FIG. 16

4. Lift the PCB straight up. The complete assembly, including face plate, will easily slide out of the bottom cover. Notice how the line cord is wrapped around the strain relief.

REASSEMBLY PROCEDURE

1. Align the PCB up with the screw mounting posts and guide the face plate back into the slots.

2. Refasten the PCB to the bottom cover with 5 screws and washers.

3. Wrap the line cord around the strain relief as shown in Fig. 17. If you have difficulty, see separate line cord installation.

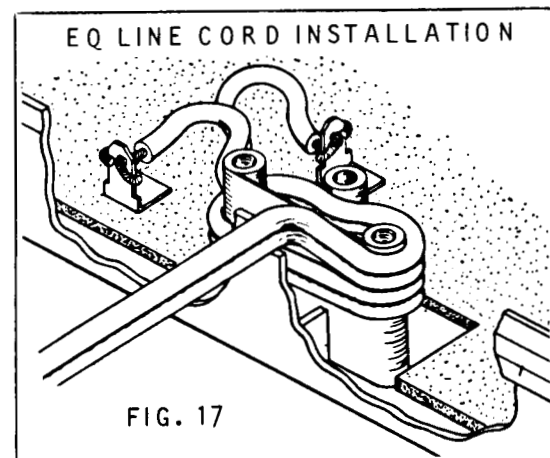


FIG. 17

4. Position top cover into place and refasten the covers with 4 screws.

220 To 110 VOLT CONVERSION

1. Perform steps 1 thru 4 in the

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Disassembly Procedure.

2. Locate jumper LK-1 in back of the power transformer and remove. (See transformer drawing on schematic.)
3. Add jumpers to LK-8 and LK-9.
4. Remove 220-volt line cord (if supplied) and replace with 110-volt line cord. Make certain the line cord is wrapped around the strain relief as shown in figure 17. (See separate installation section.)
5. Remove 220-volt power tag from back of equalizer cabinet.
6. Perform steps 1 thru 4 of the Reassembly Procedure.
7. Perform equalizer test.

110 TO 220 VOLT CONVERSION

NOTE: Conversion is not possible unless 220-volt transformer and capacitor is ordered from factory. Check parts list. (Line cord is an optional procedure depending on customer needs).

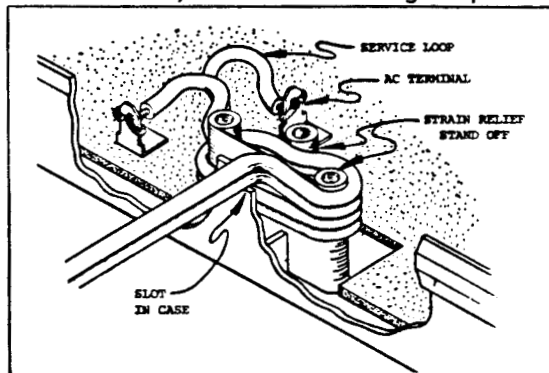
1. Perform steps 1 thru 4 in the Disassembly Procedure.
2. Remove 110-volt power transformer and capacitor and replace with 220-volt components. (See equalizer parts list).
3. Add a jumper to LK-1 directly in back of power transformer. (See transformer drawing on schematic). If LK-8 and LK-9 are installed, remove.
4. Remove 110-volt line cord (if supplied) and replace with 220-volt line cord. Make certain the line cord is wrapped around the strain relief as shown in figure 17. (See separate installation section.)
5. Add a 220-volt power label to back of equalizer cabinet.

6. Perform steps 1 thru 4 of the Reassembly Procedure.

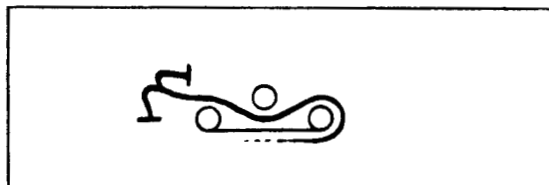
7. Perform Equalizer test.

402 EQUALIZER LINE CORD STRAIN RELIEF PROCEDURE

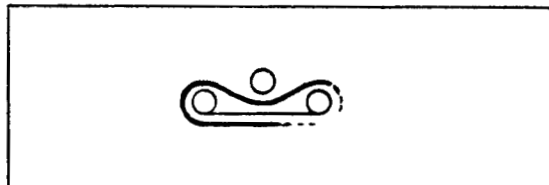
To dress the AC cord through the strain relief, do the following steps.



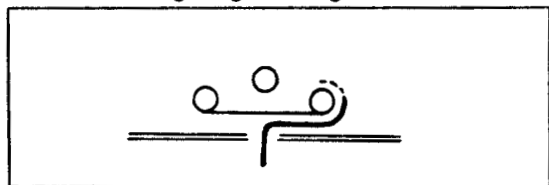
1. Leave a small loop, approximately 1/4" looped slack.
2. Place the cord clockwise through the strain relief stand-offs.



3. Loop wire back through strain relief stand-offs one additional turn.



4. Dress wire back and out through slot in case, insuring wire is pulled taut before going through case.



5. Insure wire does not get pinched while installing cover. (Push the wire down approximately 1/16" below strain relief stand-offs.

402 EQUALIZER PARTS LIST

SEMICONDUCTORS

<u>Symbol</u>	<u>Description</u>	<u>Part Number</u>
D1,2,3,4	Diode, 1N4003	116996-3
D5	Diode, 24V 1W Zener	116995-4749A
D101,102,201,202	Diode, 1N4148	116997
Q1	Transistor, PNP	119168
Q2	Transistor, NPN	117921
U101,102,201	IC, L/Noise Dual Op-Amp	108568
D6	L.E.D.	119933

CAPACITORS

<u>Symbol</u>	<u>Description</u>	<u>Part Number</u>
C1 (115/100V Version)	.0047 uF 1.4 KV UL	103447
C1 (220V Version)	.0047 uF MET Mylar S/W L	111715
C2,7,8	.01 uF 100V Disk	117501
C3,4	470 uF 35V Elec.	110704
C5,6	10 uF 35V Elec.	116998
C101,105,201,205	.0047 uF 100V 5% Film	118091-472
C102,202	100 pF 100V 5% Disk	119372-101
C103,203	.27 uF 100V 5% Film	120388-274
C104,204	0.1 uF 100V 5% Film	121040
C106,206	680 pF 50V 5% Disk	120648-681
C107,207	.0022 uF 100V 5% Film	121298
C108,208	.047 uF 100V 5% Film	118091-473
C109,110,209,210	.022 uF 100V 5% Film	118091-223
C111,211	22 uF 25V Elec.	119024
C112,113,114,212,213,214	.01 uF 100V Disk	117502

RESISTORS

<u>Symbol</u>	<u>Description</u>	<u>Part Number</u>
R4, 101,107,201,207	8.2K Ohm, 1/4 W, 5%	117704-1218225
102,202	1M Ohm, 1/4 W, 5%	117704-1211055
R3,103,104,203,204	10K Ohm, 1/4 W, 5%	117704-1211035
R105,106,205,206	3.9K Ohm, 1/4 W, 5%	117704-1213925
R108,109,208,209	1.8K Ohm, 1/4W, 5%	117704-1211825
R110,210	20K, Ohm, 1/4 W, 5%	117704-1212035
R111,211	270K Ohm, 1/4 W, 5%	117704-1212745
R112,212	2.2K Ohm, 1/4 W, 5%	117704-1212225
R113,213	4.7K Ohm, 1/4 W, 5%	117704-1214725
R114,214	510 Ohm, 1/2 W, 5%	117704-1515115
R115,215	22K Ohm, 1/4 W, 5%	117704-1212235

MISCELLANEOUS

<u>Symbol</u>	<u>Description</u>	<u>Part Number</u>
P1,2	Terminal, A.C.	111262
P3,4	Terminal .058 Formed Pin	107146-1
J101,102,201,202	Phone Jack	119333
	Screw, Mach, M3x0.5x6L	110440-06
	Screw, Thread-Forming	120088
	Lockwasher, Ext. #4	108261-04
	Audio Cable	102643

VOLTAGE COMPONENT VARIATIONS

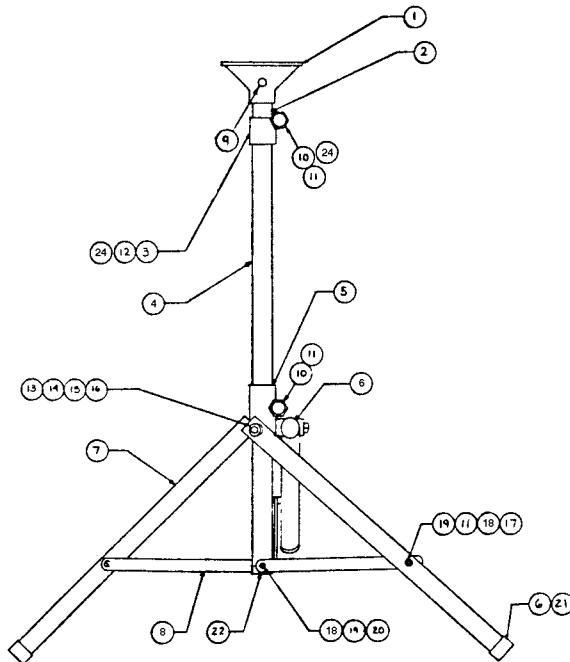
<u>Symbol</u>	<u>Description</u>	<u>Part Number</u>
T1 (Japan)	Transformer, 100V	117721
T1 (USA)	Transformer, 115V	110385
T1 (Universal)	Transformer, 110/220V	116942
C1 (115/100V Version)	.0047 uF 1.4 KV UL	103447
C1 (220V Version)	.0047 uF MET Mylar S/W L	111715
	Line Cord 100/115V	111672
	Line Cord 220V	113608

COSMETIC

<u>Description</u>	<u>Part Number</u>
Front Panel	119183
Equalizer Case, Top	116729
Equalizer Case, Bottom	116730
Literature Kit	120842
Accessory Kit	119265
Carton	120067
Pad	119136
Polybag	100688

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402 Series Accessories



SS-5 SPEAKER STAND

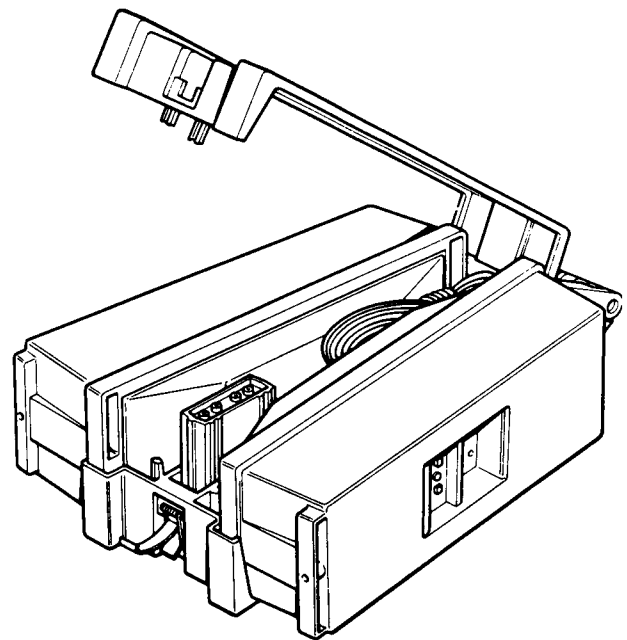
ITEM	DESCRIPTION	BOSE P/N
1	Base Mount	121526
2	Upper tube U-2	121212
3	Collar TC-2	121213
4	Lower Tube U-1	121214
5	Leg Fitting TL-12	121215
6	Compression Plug CP-112	121216
7	Leg U-3	121217
8	Brace ULB-1	121218
9	Thumb Screw K8T-144N	121219
10	Hand Knob HK-4	121220
11	Nylon Washer NW-144	121221
12	5/16-20x1" Soc Jd Cap Sc	121222
13	5/16-18x2 1/4 Hex Hd Bl	121223
14	5/16 Fender Washer	121224
15	Saddle Outside SL312	121225
16	Saddle Inside SL375	121226
17	5/16-20x2 1/4 Scw Flat Hd	121227
18	Stand Off 50-250	121228
19	5/16-20 Mylock Nut	121229
20	5/16-20x1" Flat Hd Scw	121230
21	Foot Cap MD-20-1000	121231
22	1 1/2 End Cap EC-148	121232
23	Nylon Tote Bag	121235
24	1/4-20 Nut	136786

Bose® TK-4 Transit Kit

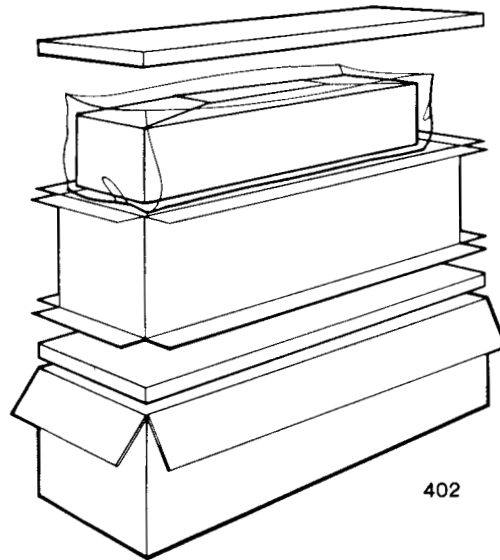
The TK-4 Transit Kit is designed to provide convenient, protected transport and storage of two Bose 402 Loudspeakers, a 402-E Active Equalizer and system accessories. The unit includes two 402 Floor Braces,* which allow 402 speakers to be positioned horizontally for use in stage monitor (foldback) applications.

TK-4 SYSTEM KIT PARTS LIST

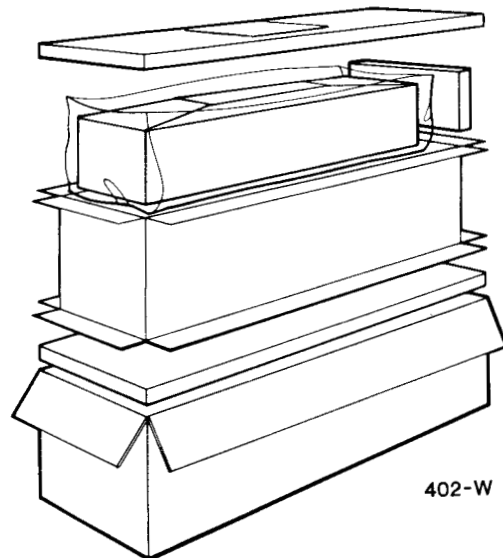
Description	Part Number
Carrying System	117575-1
Hinge Pin	119267
Latch	109480
Threaded Rod	119005
Rubber Bumper	119006
Screw #6 x .5L	103120-08
Screw Sh Met #8-18 x 5L	103124-08
Fuse Clip	121112
Audio Cable	102643
Carton	119929
Top Cap	119930
Instruction Sheet	120367



402 SINGLE CARTON PACKING ILLUSTRATION

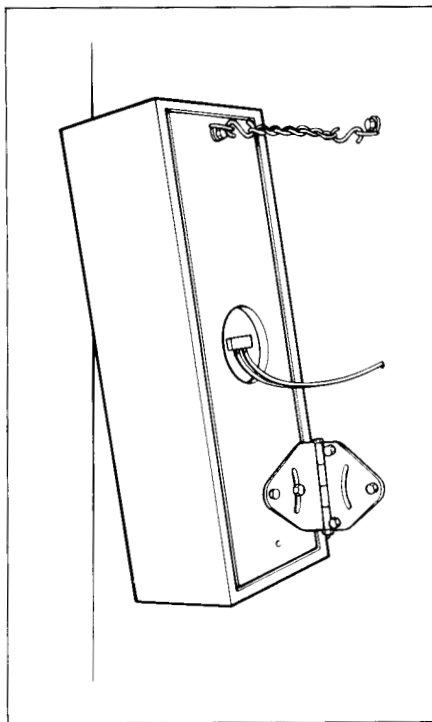


402W CARTON PACKING ILLUSTRATION



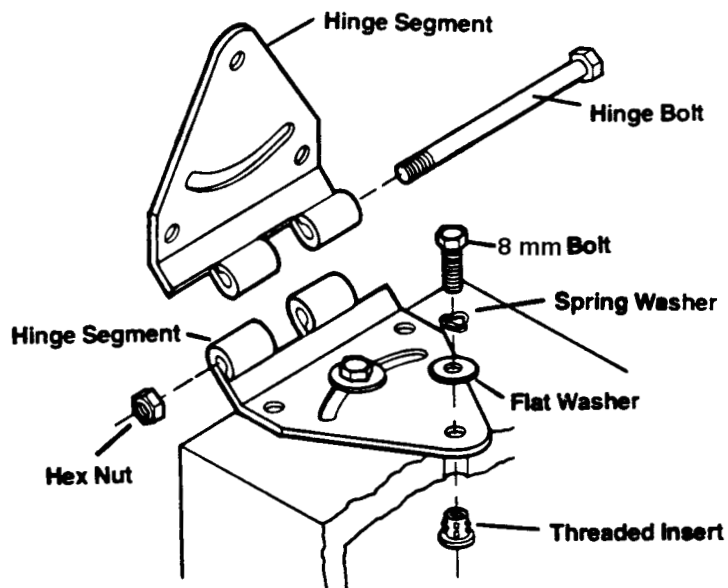
Bose® WB-2 Wall Bracket

The WB-2 Wall Bracket is a versatile hinge-and-chain system designed for fast, secure mounting of Bose 802-W and 402-W Loudspeakers with up to 60° of adjustment in 3 axes.



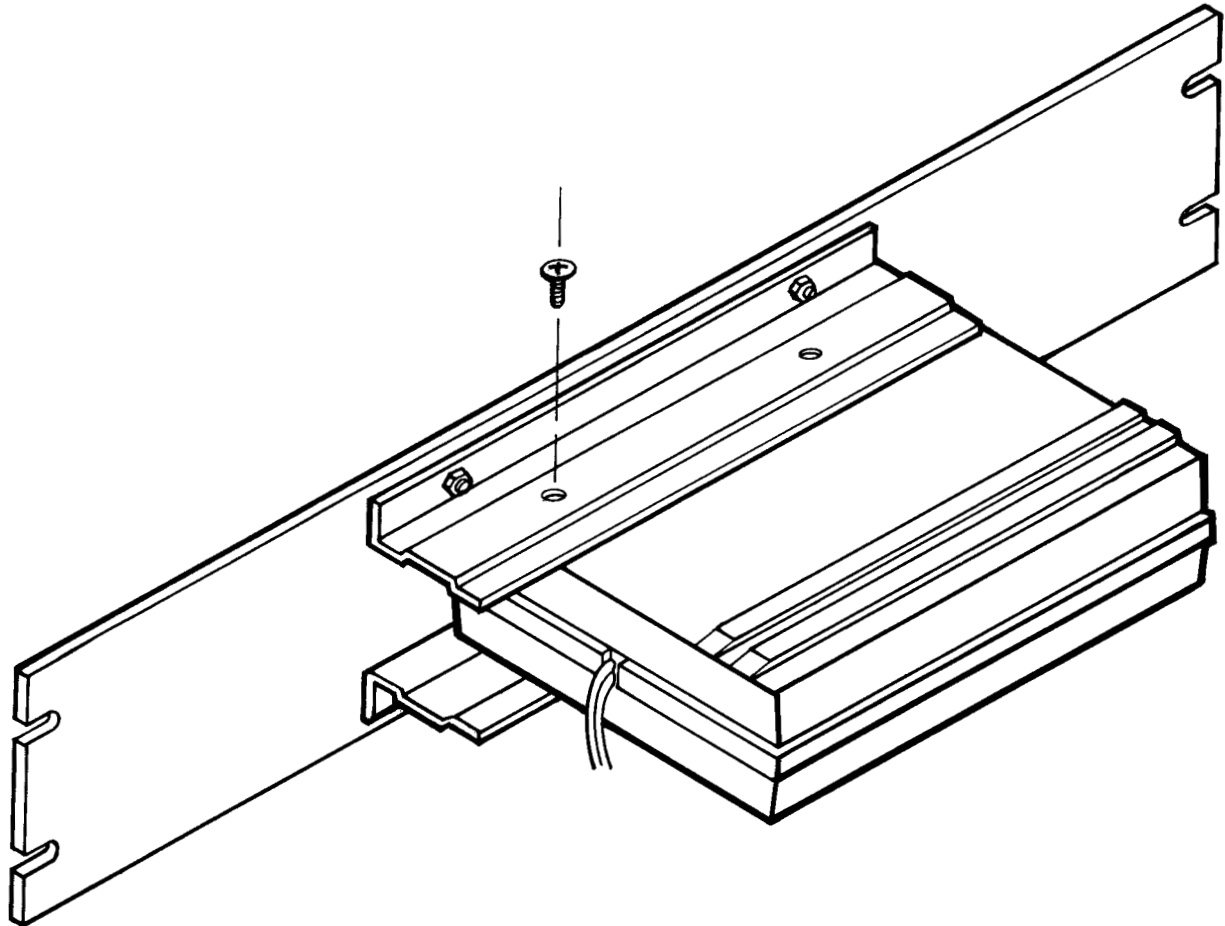
402-W Loudspeaker, side wall mount.

Description	Part #
Hinge Segments	119270
4-foot Twist-Link Chain	120079-2
Hinge Bolt	119269
Hex Stop Nut	119801
D-Rings	120093
S-Hooks	119797
8 mm Bolts	119798
8 mm Threaded Inserts	119767
Flat Washers	119799
Spring Washers	119800



Bose® RMK-4 Rack Mount Kit

Mounts the Bose 402-E Active Equalizer
in two spaces of a standard 19" equipment rack.



RACK MOUNT KIT PARTS LIST

<u>Description</u>	<u>Part Number</u>
Panel	119187
Mounting Bracket	119188
Hex Nut-Washered #6-32	100413-1
Washer #6	143295-04
Screw-Pan HD Phil #6-32	112751-06
Instruction Sheet	119670
Carton	119671
Screw-Truss Head #10-32	111200-08

Notes for Future Reference

SPECIFICATIONS AND FEATURES SUBJECT TO CHANGE WITHOUT NOTICE

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better sound through research [®]

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