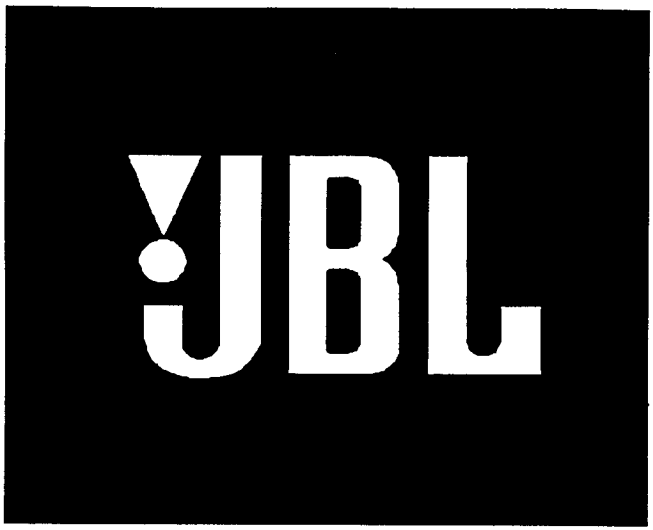

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JBL COMPONENT LISTING BY NUMERICAL CATEGORY - AS OF 4/20/89

CATEGORIES:
- 2100 - Midrange and mid-bass cone transducers
- 2200 - Low frequency transducers (woofers)
- 2300 - Horns and horn throat adapters
- 2400 - Compression drivers
- 2500 - Mounting brackets
- 3100 - Passive Crossover networks
- 4300 - Older studio monitors (enclosed systems)
- 4400 - Newer monitors and Bi-Radial monitors
- 4500 - Low frequency enclosures - unloaded
- 4600 - Theater, Cabaret & loaded low frequency enclosures
- 4700 - European Sound Power Speakers Systems and accessories
- 4800 - Concert Series loudspeaker systems
- 4900 - Concert Series complete packaged systems
- 5000 - Crossovers, Mixers, Equalizers
- 6200 - Amplifiers (high-level electronics)
- 6800 - Video Products
- 7000 - Special purpose electronics (7510B, 7110)
- 8000 - Industrial series stamped frame loudspeakers
- GXXX - G-series or Performance Series systems
- E, G, MI, - Musical instrument loudspeakers
- MTC - Control Series mounting hardware(See 2500 series info)

2100 SERIES: CONE TRANSDUCERS

- LE8T-H - 8" 40 watt full range transducer
- 2105H - 5" mid 40 W, similar to 5" in 4311, 4411 monitors
- 2108 - 8" mid, 75 W, 3" voice coil, used only in 4315B (Obsolete)
- 2110 - 8" extended range 20 W, (Obsolete)
- 2115H,J - 8" full range transducer lighter cone LE8 (Obsolete)
- 2118H,J - 8" mid 200 W, used in Cabaret Series 4612B, 4628B
- 2120 - 10" extended range 60 W, old pro version of D110 (Obsolete)
- 2121H - 10" mid 75 W, used in 4343, 4344, 4345 monitors (Obsolete)
- 2123H,J - 10" mid 250 W, (new 10-85)
- 2130 - 12" old pro version of D120 (Obsolete)
- 2135 - 15" old pro version of D130 (Obsolete)
- 2145 - 12" coax composite transducer with 1" HF (Obsolete)
- 2150 - 15" coax composite transducer with 5" HF (Obsolete)

2200 SERIES: CONE TRANSDUCERS

- 2202H - 12" midrange/midbass 300 W, used in 4350, 4355 monitors
- 2203H - 12" low bass 100 W, used in 4315 studio monitor (Obsolete)
- 2204H,J - 12" high-power bass similar to 2225H (new 10-85)
- 2205H,J - 15" predecessor of 2225H (Obsolete)
- 2215H - 15" low bass used in UREI 813C (order from UREI as replacement)
- 2220H,J - 15" high-efficiency woofer/midbass 200 W
- 2225H,J - 15" high power bass, 400 W, used in theater system enclosures
- 2230 - 15" white Aquaplas cone 15" woofer used in old 4350 (Obsolete)
- 2231A - 15" low bass 100 W, used in 4331, 4333, 4341, 4343 monitors
- 2231H - 15" predecessor of 2235H (both 2231A, H (Obsolete)
- 2234H - 15" mid-efficiency bass 150 W, two used only in 4435 monitor
- 2235H - 15" low bass 150 W, used in 4430 monitor, B380 subwoofer
- 2240G,H - 18" high-power bass 600 W
- 2245H - 18" subwoofer 600 W, used in 4645, 4845, B460
- 2290 - pro version passive 15" radiator (Obsolete)

JBL COMPONENT LISTING BY NUMERICAL CATEGORY - AS OF 4/20/89

2300 SERIES: HORNS, LENSES & ADAPTERS

- 2301 - "potato-masher" round perforated plate lens for 1" drivers (Obsolete)
- 2307 - round exponential for 1" throat (Obsolete)
- 2308 - lens for 2307, 2311, 2312 (Obsolete)
- 2311 - short round exponential for 2" throat (Obsolete)
- 2312 - long round exponential for 1" throat (Obsolete)
- 2327 - throat adapter for 2425 to 2" horns (2360-86)
- 2328 - throat adapter for 2" to large radials (2350-55-56) (Obsolete)
- 2329 - twin throat adapter for 2 x 2" to large radials (Obsolete)
- 2330 - throat adapter 1.4" (Altec) driver to 2" JBL horns (Obsolete)
- 2340 - small bent radial for 1" drivers (Obsolete)
- 2342 - screw-throat bi-radial used in 4425 monitor
- 2343 - exponential oval for 2" throat (Obsolete)
- 2344 - 12.5" square Bi-Radial used in 4430 monitor, 1" throat
- 2345 - 1" throat one-piece cast aluminum radial (Obsolete)
- 2346 - 1" throat Defined Coverage horn used in 4660
- 2350 - 2" throat large cast aluminum 90 X 40 radial (Obsolete)
- 2355 - 2" throat large cast aluminum 60 X 40 radial (Obsolete)
- 2356 - 2" throat large fiberglass 40 X 20 radial (Obsolete)
- 2360A - Large 2" throat 90 X 40 deg. Bi-Radial horn
- 2365A - Large 2" throat 60 X 40 deg. Bi-Radial horn
- 2366A - Large 2" throat 40 X 20 deg. Bi-Radial horn
- 2370A - Smaller 1" throat, flat-front 90 X 40 deg. Bi-Radial horn
- 2371 - 1" screw-throat, flat-front 90 X 40 deg. used in G series
- 2380A - Smaller 2" throat, flat-front 90 X 40 deg. Bi-Radial horn
- 2382A - Smaller 2" throat, flat-front 120 X 40 deg. Bi-Radial horn
- 2385A - Smaller 2" throat, flat-front 60 X 40 deg. Bi-Radial horn
- 2386 - Smaller 2" throat, flat-front 40 X 20 deg. Bi-Radial horn
- 2390 - 2" serpentine lens horn for 2" driver (Obsolete)
- 2395 - 36" slant plate horn/lens for 2445J (Obsolete)
- 2397 - "Smith horn" - wood construction diffraction horn (Obsolete)

2400 SERIES: COMPRESSION DRIVERS

- 2402H - ring radiator tweeter (JBL "Bullet") Note 1
- 2403H - oval horn tweeter (Obsolete)
- 2404H - Bi-Radial 100 X 100 deg. tweeter (SALES MODEL) Note 2
- 2404H-1 - used in Cabaret models 4612B, 4628B, and 4698B Note 1
- 2405H - diffraction slot tweeter Note 2
- 2410 - 1" throat, aluminum diaphragm comp. driver (Obsolete) *
- 2420 - 1" throat, aluminum diaphragm comp. driver (Obsolete) *
- 2421 - as above, used in older 4430, 4435 monitors *
- 2426H,J - 1" throat, titanium diaphragm comp. driver (Obsolete) *
- 2426H,J - 1" throat, titanium diaphragm comp. driver
- 2427H,J - 2" throat version of 2426 type driver (late 1987)
- 2440 - 2" throat, aluminum diaphragm comp. driver (Obsolete) *
- 2441 - 2" throat, aluminum diaphragm comp. driver *
- 2445J - 2" throat, titanium diaphragm comp. driver
- 2450J - 2" neodymium magnet/titanium diaph. comp. driver (Available 5-88)
- 2460 - 1" throat, phenolic diaphragm comp. driver (Obsolete) *
- 2461 - 1" throat, phenolic diaphragm comp. driver (Obsolete) *
- 2470 - 1" throat, phenolic diaphragm comp. driver (Obsolete) *
- 2482 - 2" throat, phenolic diaphragm comp. driver (Obsolete '86)
- 2485J - 2" throat, phenolic diaphragm comp. driver (replaces 2482)
- 375AB - fog horn driver - contact JBL for information.
- 375EX - explosion-proof driver - contact JBL for information.

Notes: * - new titanium diaphragm assemblies retrofit these models.
1 - models use 0.0015" replacement diaphragm model D8R075
2 - models use 0.0010" replacement diaphragm model D16R2405
(3105 crossover provides correct frequency with both models.)

JBL COMPONENT LISTING BY NUMERICAL CATEGORY - AS OF 4/20/89

2500 SERIES: MOUNTING HARDWARE, STANDS, ACCESSORIES

100WA-BC - Omnimount Wall bracket for 8330 (10 ea per master pack)
2504 - Driver mounting "L" bracket for 2402 and 2405
2506 - Mounting bracket for 2360 and 2365 horns (theater systems)(OBSOLETE)
2506A - Mounting bracket for 2360 and 2365 horns (theater systems)
2507 - 3-way adjustable bracket for 1" throat horns
2508 - Mounting "L" bracket for 2380 series horns
2509 - 3-way adjustable bracket for 2" throat horns
MA15 - Mounting clamp kit for woofers
MC4401 - Mounting cradle for 4401 studio monitor
MT4612 - Tripod stand for 4612B, 4825, G-730, G-733, G-734
MTC-1 - Camera tripod mounting adapter for Control 1 (12ea per master pak)
MTC-2 - Ceiling wall-mount, ball joint bracket for Control 1 (12 ea per master pak
MTC-2-MG - Medium grey ceiling/wall-mount bracket for Control 1
MTC-2-WH - White ceiling/wall-mount bracket for Control 1
MTC-3 - Clamp mounting system Control 1
MTC-4 - European mic stand adapter for use with MTC-1 (20 ea per master pak)
MTC-5 - American 3/4" mic stand adapter for use with MTC-1 (20 ea per master pak)
MTC-6 - Japanese mic stand adapter for use with MTC-1 (20 ea per master pak)
MTC-7 - Includes and MTC-5 and MTC-1 (12 ea per master pak)
MTC-8 - Ceiling/wall-mount "L" bracket for Control 1 (10 ea per master pak)
MTC-51 - Wall-mount, ball joint bracket for Control 5 (6 ea per master pak)
MTC-52 - Ceiling-mount, ball joint bracket for Control 5 (6 ea per master pak)
MTC-53 - Rack mount bracket fits 19" EIA standard rack for Control 5 (4 ea per mast
MTC-54 - Control 5/MT4612 tripod mounting adapter (6 ea per master pak)
MTC-56 - Wall-mount, low cost, slide mount bracket for Control 5
MTC-101 - Universal mounting adapter for Control 10/12SR/MT4612
MTC-102 - Wall-mount
MTC-103 - Ceiling-mount
MTC-104 - Home floor stand
MTC-105 - Mounting Yoke
MTC 106 - Coth cover

3100 SERIES: PASSIVE FREQUENCY DIVIDING NETWORKS

3101A power pack crossover - 1500 Hz (Obsolete) (use 3120A)
3102 power pack crossover - 3000 Hz (Obsolete) (use 3105)
3104 power pack crossover - 3000 Hz (Obsolete) (use 3105)
3105 - 7000 Hz, 70 W, for 2426J or 2445J and 2402H, 2404H, or 2405H
3110A - 800 Hz, 300 W, with power response correction for Bi-Radial horns
3115A - 500 Hz, 300 W, with power response correction for Bi-Radial horns
3120A - 1250 Hz, 300 W, with power response correction for Bi-Radial horns
3160 - 500 Hz, 600 W, with power response correction for Bi-Radial horns

4300 SERIES: CONTROL MONITORS

4312A L,R - three-way system, 12" woofer, 5" mid, titanium dome tweeter
CONTROL-1 - miniature two-way loudspeaker system, molded enclosure
CONTROL-1MG - medium gray, miniature two-way loudspeaker system, molded enclosure
CONTROL-1SLVR - silver, miniature two-way loudspeaker system, molded enclosure
CONTROL-1WH - white, miniature two-way loudspeaker system, molded enclosure
CONTROL-5 - small two-way loudspeaker system, molded enclosure
CONTROL-5GY - gray, small two-way loudspeaker system, molded enclosure
CONTROL-5MG - medium gray, small two-way loudspeaker system, molded enclosure
CONTROL-5WH - white, small two-way loudspeaker system, molded enclosure
CONTROL-10 - 12" 3-way loudspeaker system, molded enclosure
CONTROL-12 SR - 2-way molded enclosure loudspeaker system w/G-125B-8,2416H, 2372
SLT-1 - miniature two-way loudspeaker system, die-cast aluminum enclosure

JBL COMPONENT LISTING BY NUMERICAL CATEGORY - AS OF 4/20/89

4400 SERIES: STUDIO MONITORS

4406 - two-way system, 6.5" woofer, titanium dome tweeter
4408 - two-way system, 8" woofer, titanium dome tweeter
4410L,R - three-way system, 10" woofer, 5" mid, titanium dome tweeter
4412L,R - three-way system, 12" woofer, 5" mid, titanium dome tweeter
4425L,R - two-way system, 12" woofer, Bi-Radial horn
4430L,R - two-way system, 15" woofer, Bi-Radial horn
4435L,R - two-way system, dual 15" woofers, Bi-Radial horn

4500 SERIES: UNLOADED LOW FREQUENCY ENCLOSURES

4507 - 5 cubic foot vented box for single 15" driver tuned to 40 Hz
4508 - 8 cu ft vented box for double 15" drivers tuned 40 Hz
4512 - 1.2 cu ft vented box for single 12" driver tuned 50 Hz
4518 - 8 cu ft vented subwoofer box for single 18" driver tuned 30 Hz
4550BKA - Dual 15" transducer, front loading horn, utility black, limited availabilit
4560BKA - Single 15" transducer, front loading horn, utility black, limited availabil
4520 - Rear loading, vented,dual 15" transducer folded horn Obsolete
4530 - Rear loading, vented, single 15" transducer folded horn Obsolete

CABARET SERIES LOUDSPEAKER SYSTEMS:

4602B - small wedge stage monitor, E120-8, 2402H
4604B - small stand-mount vocal system, (2) 2118J, 2404H-1*
4622M - dual 12" cabinet often specified by Jaffe Acoustics, not JBL product
4625B - 4-cu ft bass guitar and low-frequency box w/E140-8
4628B - 4-cu ft three-way all purpose system, E145-8, 2118H, 2404H-1*
4680B - column w/(4) E110, (2) 2402 (Obsolete)
4691B - 4-cu ft two-way all purpose system, E140-8, 2370A/2426J
4695B-4 - 10 cu ft subwoofer/bass guitar with E155-4
4698B - 10 cu ft three-way all purpose system, E155-4, E110-8, 2404H-1*
4699B - 10 cu ft three-way all purpose system, E155-4, E110-8, 2370A/2426H
4602CVR - hard cover for 4602B
4612CVR - hard cover for 4612B
4620CVR - hard cover for 4604B, 4625B, 4691B
4695CVR - hard cover for 4695B, 4698B, 4699B

NOTE: Cabaret version of the 2404 tweeter (2404H-1) uses D8R075 replacement diaphragm.
Unloaded Low Frequency Enclosures

4700 SOUND POWER SERIES COMPONENTS:

4716 - two-way passive crossove,small monitor w/ 2123h, 2342, 2416H
4726 - two-way, bi-amped full range small monitor w/2204H, 2344/2426H
4728 - two-way bi-amped full range small floor wedge monitor w/2204H, 2344/2426H
4742 - double 2204H direct-radiator subwoofer
4745 - double 2225H direct-radiator subwoofer
4748 - single 2240H direct-radiator subwoofer
4750 - two-way full range trapezoid enclosure w/2-2204H, 2380A/2445J
4751 - two-way full range trapezoid enclosure w/2-2204H, 2380A/2445J, 2-2404
4755 - two-way full range rectangular enclosure w/2-2204H, 2380A/2445J
4756 - two-way full range rectangular enclosure w/2-2204H, 2380A/2445J, 2-2404
4770 - two-way full-range trapezoid enclosure w/2-2225H, 2380A/2445J
4771 - two-way full-range trapezoid enclosure w/2-2225H, 2380A/2445J, 2-2404
4782 - Triple Chamber Bandpass sub-bass w/two 2204H
4785 - Triple Chamber Bandpass sub-bass w/two 2225H
4788 - Triple Chamber Bandpass sub-bass w/two 2240H

JBL COMPONENT LISTING BY NUMERICAL CATEGORY - AS OF 4/20/89

Sound Power Series Accessories:

MA2402 - 2402/04 MOUNTING ADAPTER PLATE
3700CA - 3700 CABLE PER METER
370 - 1.5 METER EP-8 CABLE
3 - 5 METER EP-8 CABLE
3733 - 10 METER EP-8 CABLE
3765 - 20 METER EP-8 CABLE
4700PNT - TOUCH UP PAINT FOR THE 4700 SERIES
4701PNL - XLR IN XLR OUT
4702PNL - XLR IN EP-8 OUT
4710PNL - POWER PANEL
4716BRK - 4716 MOUNTING BRACKET
4726BRK - 4726 MOUNTING BRACKET
N4726 - 4726/ 4728 PASSIVE CROSSOVER NETWORK
4750CVR - COVER FOR THE 4750
4750DL - DOLLY FOR THE 4750
N4750 - 4750/ 4755/ 4770 PASSIVE CROSSOVER WITH POWER CORRECTION
4750PC - 4750/ 4755/ 4770 PASSIVE POWER CORRECTION FOR ACTIVE CROSSOVERS
4755BRK - 4755 MOUNTING BRACKET
4770CVR - COVER FOR THE 4770
4770DL - DOLLY FOR THE 4770
4782CVR - COVER FOR THE 4782
4785DL - DOLLY FOR THE 4785
4788DL - DOLLY FOR THE 4788
EP-8-11 - EP-8 FEMALE CABLE CONNECTOR
EP-8-12 - EP-8 MALE CABLE CONNECTOR
EP-8-13 - EP-8 FEMALE CHASSIS CONNECTOR
EP-8-14 - EP-8 MALE CHASSIS CONNECTOR

LOADED LOW FREQUENCY SYSTEMS:

4645 - 4518, 8 cubic foot VLF enclosure w/2245H 18" subwoofer
4646 - 4512, 1.2 cubic ft LF enclosure w/2204H 12" woofer
4647 - 4507, 5 cubic foot LF enclosure w/2225H 15" woofer
4648 - 4508, 8 cubic foot LF enclosure w/two 2225H 15" woofers

ENCLOSED UTILITY SYSTEMS:

4612OK - oak vinyl covered version of 4612B for fixed installations
4660 - Defined Coverage "instant cluster" hanging speaker system
4671OK - oak vinyl, self-contained version of 4671 theater system

JBL COMPONENT LISTING BY NUMERICAL CATEGORY - AS OF 4/20/89

THEATER/SOUND REINFORCEMENT SYSTEMS: (assembled by customer)

4662A - two-way system, 4560BKA, E140-8, 2370A/2426J
4663A - three-way system, 4560BKA, E140-8, 2370A/2426J, 2405H
4670B - two-way system, 4508, (2) 2225H, 2380A/2445J, 3160
4671 - two-way system, 4507, 2225H, 2370A/2426J, 3110A
4672A - two-way system, 4560BKA, 2225H, 2370A/2426J, 3110A
4673 - two-way system, 4507, 2225H, 2380A/2445J, 3115A
4674A - two-way system, 4560BKA, 2225H, 2380A/2445J, 3115A
4675A - two-way system, 4508, (2) 2225H, 2360A/2445J, 3160, 2506
4675A-2 - two-way system, (2) 4508, (4) 2225J, 2360A/2445J, 3160, 2506
4676B-1 - two-way system, 4550BKA, (2) 2225H, 2360A/2445J, 3160, 2506
4676B-2 - two-way system, (2) 4550BKA, (4) 2225J, (2) 2365A/2445J,(2) 3160,(1) 9375,

NOTE: All Theater System orders should include a copy of JBL Tech Note: "Instruction Manual - Motion Picture Loudspeaker Systems".

4800 CONCERT SERIES COMPONENTS:

4825 - two-way full range small monitor w/2204H, 2344/2426H
4828 - two-way full range small floor wedge monitor w/2204H, 2344/2426H
4842 - double 2245H direct-radiator subwoofer
4845 - single 2245H direct-radiator subwoofer
4847 - single 2225H direct-radiator low frequency driver
4850 - two-way full range small column w/2-2204H, 2380A/2445J
4851 - two-way full range small column w/2-2204H, 2380A/2445J, 2-2404
4852 - two-way full range small column w/2-2204H, 2385A/2445J
4853 - two-way full range small column w/2-2204H, 2385A/2445J, 2-2404
4850DL - speaker dolly for all 4850 models
4860 - single 2380A/2445J in heavy road cabinet
4862 - single 2385A/2445J in heavy road cabinet
4863 - single 2385A/2445J, (2) 2404H in heavy road cabinet
4866 - two 2386/2445J in heavy road cabinet
4870 - two-way full-range w/2-2225H, 2380A/2445J
4871 - two-way full-range w/2-2225H, 2380A/2445J, 2-2404
4872 - two-way full-range w/2-2225H, 2385A/2445J,
4873 - two-way full-range w/2-2225H, 2385A/2445J, 2-2404
4870DL - speaker dolly for all 4870 and 4840 models

4900 CONCERT SERIES COMPLETE PACKAGED SYSTEMS:

4921 (2) 4850 or 4852, 9922 rack, (2) 3850 cables
4921T (2) 4851 or 4853, 9922 rack, (2) 3850 cables
4922 (2) 4870 or 4872, 9922 rack, (2) 3850 cables
4922T (2) 4871 or 4873, 9922T rack, (2) 3850 cables
4923 (2) 4870 or 4872, (2) 4845, 9923 rack, (2) 3850 + (2) 3805 cables
4923T (2) 4871 or 4873, (2) 4845, 9923T rack, (2) 3850 + (2) 3805 cables
4924 (2) 4850 or 4852, (2) 4845, 9923 rack, (2) 3850 + (2) 3805 cables
4924T (2) 4851 or 4853, (2) 4845, 9923T rack, (2) 3850 + (2) 3805 cables
4925 (2) 4825, 9922 rack, (2) 3850 cables
4926 (4) 4825, 9922 rack, (2) 3850 + (2) 3805 cables
4927 (8) 4825, 9942 rack, (4) 3850 + (4) 3805 cables
4941 (4) 4850 or 4852, 9942 rack, (4) 3850 cables
4941 (4) 4851 or 4853, 9942T rack, (4) 3850 cables
4942 (4) 4870 or 4872, 9942 rack, (4) 3850 cables
4942T (4) 4871 or 4873, 9942T rack, (4) 3850 cables
4943 (4) 4870 or 4872, (4) 4845, 9943 rack, (4) 3850 + (4) 3805 cables
4943T (4) 4871 or 4873, (4) 4845, 9943T rack, (4) 3850 + (4) 3805 cables
4944 (4) 4850 or 4852, (2) 4842, 9943 rack, (4) 3850 + (2) 3805 cables
4944T (4) 4851 or 4853, (2) 4842, 9943T rack, (4) 3850 + (2) 3805 cables
4945 (2) 4825, (2) 4845, 9923 rack, (2) 3850 + (2) 3805 cables
4946 (4) 4825, (2) 4842, 9923 rack, (4) 3850 + (2) 3805 cables

JBL COMPONENT LISTING BY NUMERICAL CATEGORY - AS OF 4/20/89

9900 CONCERT SERIES ACCESSORIES:

9916RC - road case for 9920 electronics rack
9920RC - road case for 9940 electronics rack
3805 - 5-foot speaker cable
3850 - 50-foot speaker cable
MT4612 - tripod for 4825 speakers

5000 SERIES: SIGNAL-LEVEL ELECTRONICS

5234A - Electronic frequency dividing network and Plug-in cards
5235 - Replacing 5234A sometime in 1987 - functionally identical
5330 - six-channel mixer with VCA control
5336 - six-channel plug-in VCA channel control card for 5330
5547A - 1/3 octave boost/cut general purpose graphic equalizer
5549A - 1/3 octave cut-only graphic room equalizer
SC5 - security cover for 5530, 5547, 5549

NOTE: 5234, 5234A and 5235 will all work with all current plug-in cards.

PLUG-IN CROSSOVER CARDS FOR 5234A or 5235:

CROSSOVER CARD CODE:
51-xxxx - 18 dB/octave
52-xxxx - 12 dB/octave
xx-51xx - no EQ
xx-52xx - Constant Coverage Bi-Radial EQ (2344, 2360, 2365, 2366 horns)
xx-53xx - Flat Front Bi-Radial EQ (2370, 2380, 2382, 2385, 2386 horns)

CARD SALES MODEL NUMBERS:

51-5130 - blank 18 dB/octave
51-5132 - 500 Hz/18 dB/octave
51-5133 - 800 Hz/18 dB/octave
51-5138 - 80 Hz/18 dB/octave (for all JBL subwoofer systems)
51-5145 - 290 Hz/18 dB/octave (for the 4345,4344 and 4355 Studio Monitors)
51-5232 - 500 Hz/18 dB/octave CCBREQ (for 2360 series horns)
51-5233 - 800 Hz/18 dB/octave CCBREQ (for 2360 series horns)
51-5332 - 500 Hz/18 dB/octave FFBREQ (for 2380 series horns)
51-5333 - 800 Hz/18 dB/octave FFBREQ (for 2380 series horns)
51-5334 - 1200 Hz/18 dB/octave FFBREQ (for 2370 & 80 series horns)
51-5336 - 1600 Hz/18 dB/octave FFBREQ (for 2370 & 80 series horns)
52-5120 - blank 12 dB/octave
52-5121 - 250 Hz/12 dB/octave
52-5122 - 500 Hz/12 dB/octave
52-5123 - 800 Hz/12 dB/octave
52-5124 - 1200 Hz/12 dB/octave
52-5125 - 5000 Hz/12 dB/octave
52-5127 - 7000 Hz/12 dB/octave
52-5130 - for 4430 & 4435 studio monitors
52-5140 - for 4350 & 4355 (Obsolete) studio monitors
52-5222 - 500 Hz/12 dB/octave CCBREQ (2360 series)
52-5223 - 800 Hz/12 dB/octave CCBREQ (2360 series)
52-5322 - 500 Hz/12 dB/octave FFBREQ (2380 series)
52-5323 - 800 Hz/12 dB/octave FFBREQ (2380 series)

JBL COMPONENT LISTING BY NUMERICAL CATEGORY - AS OF 4/20/89

6200 SERIES: AMPLIFIERS AND AUTOFORMERS/TRANSFORMERS

6210 - amp; 35 W/8 ohm, 45 W/4 ohm (single channel amp, mounts on speaker)
6211 - amp; 35 W/8 ohm, 45 W/4 ohm (like 6210, with mic/line input (XL))
6215 - amp; 35 W/ch - 8 ohm, 70 W bridged - 8 ohm
6230 - amp; 75 W/ch - 8 ohm, 150 W/ch - 4 ohm, 300 W bridged - 8 ohm
6260 - amp; 150 W/ch - 8 ohm, 300 W/ch - 4 ohm, 600 W bridged - 8 ohm
6290 - amp; 300 W/ch - 8 ohm, 600 W/ch - 4 ohm, 1200 W bridged - 8 ohm
6200SC - security cap set for securing amp level controls
6218 - 45 W autoformer 4 ohm to 109 ohm (27:1 impedance ratio)
9375 - 150 W autoformer 4 ohm to 36 ohm (9:1 impedance ratio)
6238 - 150 W transformer 4 ohm to 36 ohm "
6267 - 300 W autoformer 4 ohm to 16 ohm (4:1 impedance ratio)
6268 - 300 W transformer 4 ohm to 16 ohm "
6297 - 600 W autoformer 4 ohm to 8 ohm (2:1 impedance ratio)
6298 - 600 W transformer 4 ohm to 8 ohm "

6800 SERIES: VIDEO PRODUCTS

6810 - Video Projector-Nominal 120v, NTSC, Built in 10W amp and US NTSC Tuner
6820 - Video Projector-Nominal 220v, NTSC/PAL with Automatic Switching
MA6810.-.Ceiling Mount for the 6810 and 6820
VG-1 - Convergence pattern generator for 6810/6820 setup

7000 SERIES: SPECIAL ELECTRONICS

7110 - New fully adjustable single rack space compressor/limiter
7510B - Automatic microphone mixer, 4 to 24 inputs, individual outputs
7510-03 - four input module for 7510B
7922 - Digital Delay, 200 microseconds to 327 milliseconds, 1 in, 2 out
U16-14550 -.Line Level output transformer for the 7110,

8000 SERIES: INDUSTRIAL SERIES LOUDSPEAKERS

8110H - 5" ceiling loudspeaker
8120H - 8" ceiling loudspeaker
8130H - 8" ceiling loudspeaker
8140H - 8" "Co-Motional" ceiling loudspeaker (true coaxial loudspeaker)
8216A - two-way system, 6.5" woofer, dome tweeter
8216AT - 8216 w/built-in 8- ohm and 16, 8, 4, 2 watt, 70 volt transformer
8325A - three-way system, 10" woofer, 5" mid, dome tweeter
8325B - three-way system for motion picture theater surround use
8330 - three-way system for motion picture theater surround use, trapezoidal
WB8 - ceiling-mount grille for 8" loudspeakers

NOTE: INDUSTRIAL SERIES LOUDSPEAKER OPTION SUFFIXES:
H - loudspeaker only
HT - loudspeaker with 70/25-volt transformer attached
HTWB - loudspeaker assembled with transformer and grille

9000 SERIES: AUTOTRANSFORMERS

9315HT - 5-watt, 70-volt transformer for I-series (8100) loudspeakers
9 - 100-watt autoformer with 2:1, 4:1 and 8:1 impedance ratio taps 4, 8, 16, an

PERFORMANCE SERIES (G-series) SYSTEMS:

G-730 - two-way system w/G125-8 & G-791
G-731 - dual-angle floor monitor wedge w/G-730 components
G-732 - two-way, horn loaded system w/G-135A-8 & G-971
G-733 - three-way system w/MI-10, 2118 & G-791

JBL COMPONENT LISTING BY NUMERICAL CATEGORY - AS OF 4/20/89

G-734 - two-way, direct radiator system w/G135A-8 & G-791
G-791 - High Frequency power pack w/2371 horn, 2416H driver and network

MUSICAL INSTRUMENT LOUDSPEAKERS LOUDSPEAKERS:

E110-8 - 10" wide range, guitar, vocal
E120-8,-16 - 12" wide range, guitar, bass, vocal
E130-8 - 15" wide range, guitar, bass, vocal
E140-8 - 15" bass guitar, general purpose bass
E145-8 - 15" general purpose bass
E155-8,-4 - 18" general purpose bass

G125-8 - 12" guitar, bass, vocal
G135A-8 - 15" guitar, bass, vocal

MI-10 - 10" guitar, vocal (used in G-733, not sales model)

TRANSDUCER SUFFIXES:

A = 8 ohm voice coil impedance - Alnico Magnet Structure
B = 16 ohm voice coil impedance - Alnico Magnet Structure
G = 4 ohm voice coil impedance - Ferrite Magnet Structure
H = 8 ohm voice coil impedance - Ferrite Magnet Structure
J = 16 ohm voice coil impedance - Ferrite Magnet Structure
-4 = 4 ohm voice coil impedance - Ferrite Magnet Structure
-8 = 8 ohm voice coil impedance - Ferrite Magnet Structure
-16 = 16 ohm voice coil impedance - Ferrite Magnet Structure

JBL COMPONENT LISTING BY NUMERICAL CATEGORY - AS OF 4/20/89

6200 SERIES: AMPLIFIERS AND AUTOFORMERS/TRANSFORMERS

6210 - amp; 35 W/8 ohm, 45 W/4 ohm (single channel amp, mounts on speaker)
6211 - amp; 35 W/8 ohm, 45 W/4 ohm (like 6210, with mic/line input (XL))
6215 - amp; 35 W/ch - 8 ohm, 70 W bridged - 8 ohm
6230 - amp; 75 W/ch - 8 ohm, 150 W/ch - 4 ohm, 300 W bridged - 8 ohm
6260 - amp; 150 W/ch - 8 ohm, 300 W/ch - 4 ohm, 600 W bridged - 8 ohm
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-4 = 4 ohm voice coil impedance - Ferrite Magnet Structure
-8 = 8 ohm voice coil impedance - Ferrite Magnet Structure
-16 = 16 ohm voice coil impedance - Ferrite Magnet Structure

JBL LOUDSPEAKER MOUNTING HOLE AND BOLT CIRCLE DIMENSIONS:

	mounting holes:	bolt circles:
for 8" drivers:	7 - 1/16"	7 - 5/8"
for 10" drivers:	9"	9 - 3/4"
for 12" drivers:	11 - 1/16"	11 - 9/16"
for 15" drivers:	13 - 31/32"	14 - 9/16"
for 18" drivers:	16 - 13/16"	17 - 3/8"

VOLUME DISPLACED BY JBL LOUDSPEAKERS:

10" drivers = .1 cubic foot
12" drivers = .15 cubic foot
15" drivers = .2 cubic foot
18" drivers = .3 cubic foot

USEFUL CONVERSION FACTORS AND PHYSICAL FORMULAS

liters	feet³	inches³	meters³	feet	inches
.016387	.000578	1	.0000164	1	12
1	.0353	61.0	.001	.08333	1
28.32	1	1,728	.02832	3.281	39.37
1000	35.31	61.024	1		

SOUND VELOCITY:

meters/second	feet/second	inches/second	tempr
342.5	1125	13,500	20 C
344	1130	13,560	22 C

SOUND WAVE LENGTH = velocity / frequency
FREQUENCY = velocity / wavelength

AREA OF CIRCLE = pi (radius²)
DIAMETER OF CIRCLE = 2 [$\sqrt{(\text{area}/\text{pi})}$]

[radius = 1/2 diameter]
[pi = 3.1416]

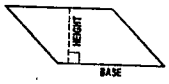
VOLUME OF TUBULAR DUCT = (circular area)(length)
VOLUME OF TRIANGULAR BOX SECTION = (1/2 base)(height)(length)

MENSURATION FORMULAE FOR COMMON SHAPES, compiled by Drew Daniels, 10–88

TRIANGLE:

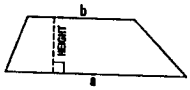
AREA = .5 BASE×HEIGHT

PARALLELOGRAM:



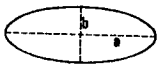
AREA = BASE×HEIGHT

TRAPEZOID:



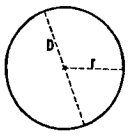
AREA = .5 HEIGHT×(a+b)

ELLIPSE:



AREA = π a b

CIRCLE:

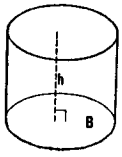


AREA = πr^2

CIRCUMFERENCE = πD

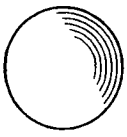
DIAMETER = $2\times\sqrt{area/\pi}$

CYLINDER:



VOLUME = Bh

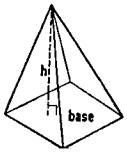
SPHERE:



SURFACE AREA = $4\pi r^2$

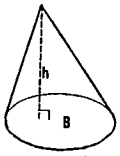
VOLUME = $4\pi r^3/3$

PYRAMID:



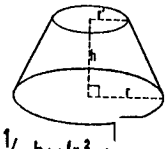
VOLUME = $\frac{1}{3}$base×h

CONE:



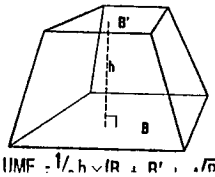
VOLUME = $\frac{1}{3}$Bh

CONE FRUSTUM:

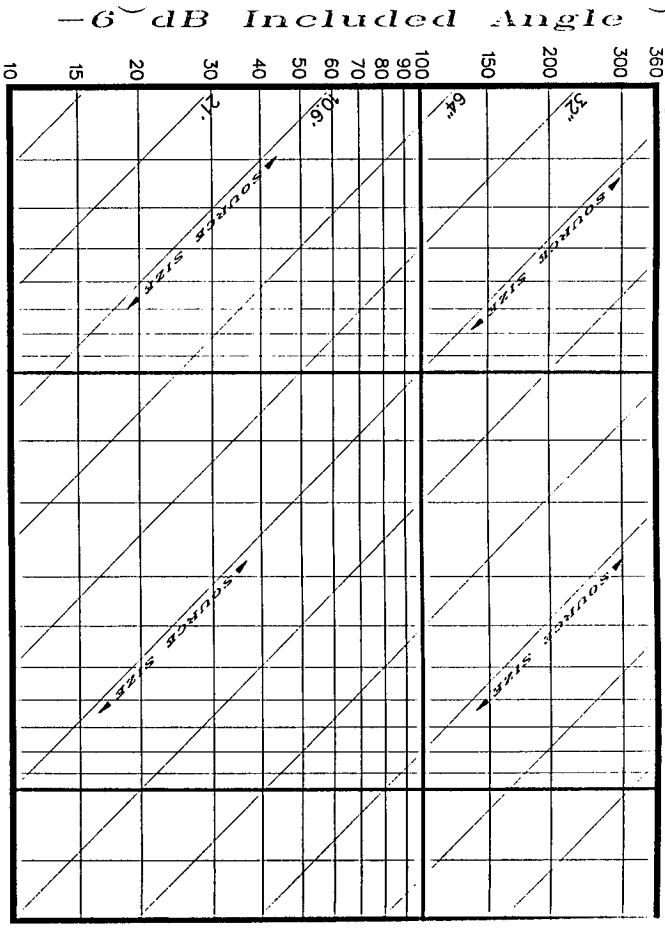


V = $\frac{1}{3}$ h×(r² + , + r×r')

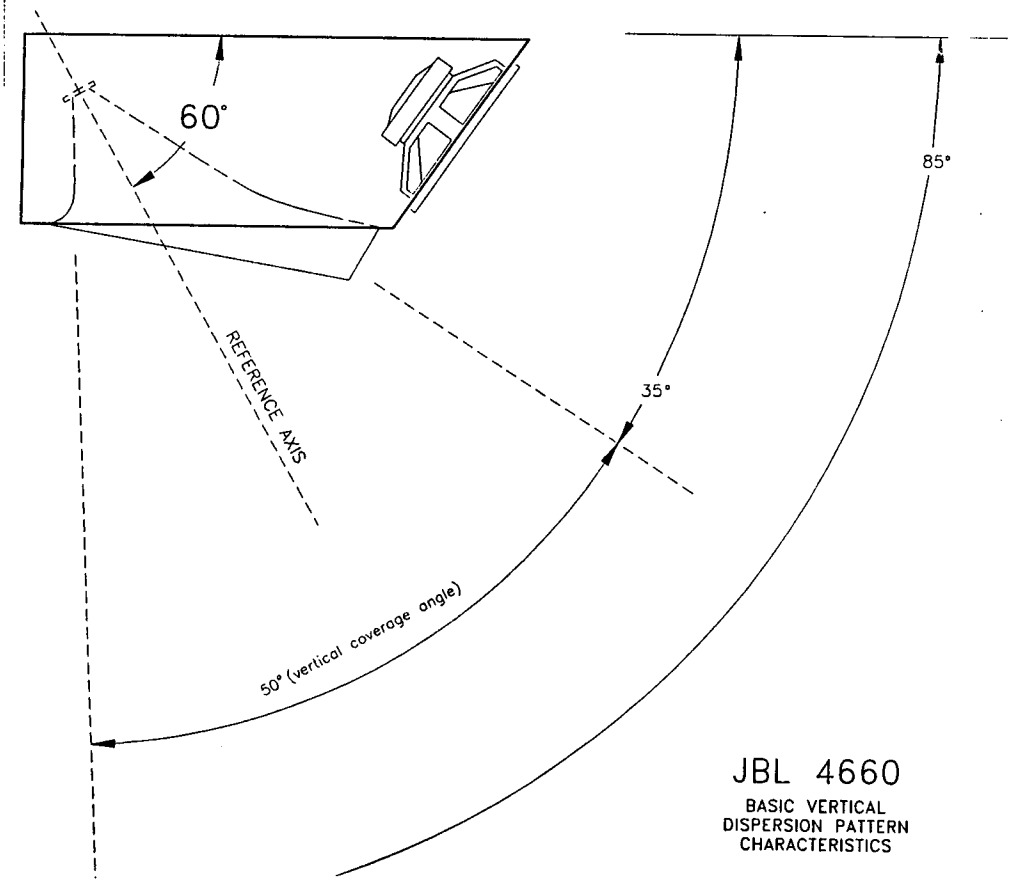
PYRAMID FRUSTUM:



VOLUME = $\frac{1}{3}$h×(B + B' + $\sqrt{B B'}$)

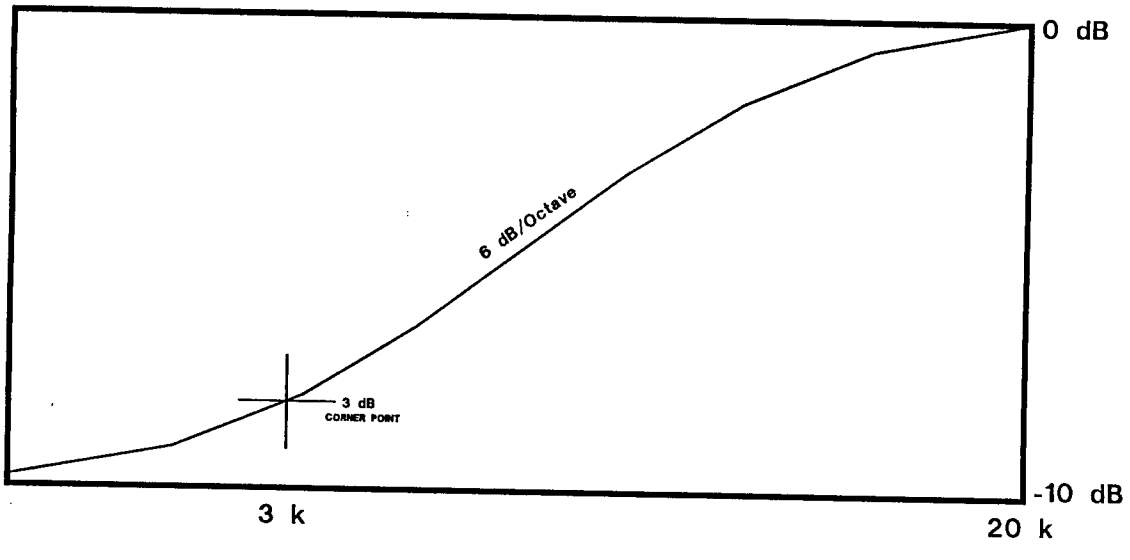


Radiation angle or included angle of dispersion of loudspeakers is a function of source size and sound wave length, not brand, model or cost, as some advertising seeks to represent. Flat baffles such as wall surfaces or ceilings tend to force half-space radiation of low frequencies (long wavelengths) from flush-mounted sources, with the -6 dB points at about 80 degrees off axis, or 160 degrees included angle. As frequency rises and wavelengths shrink to near the size of the aperture of the sound source, beaming takes place. This frequency-dependent beaming can be regarded, for simplicity, as starting its narrowing when the wavelength shrinks to the circumference, or about three times the diameter, of the source. Thus an 8-inch ceiling speaker with a grille opening of 6.5 inches in diameter will exhibit at least a 90 degree included angle of dispersion to nearly 3 kHz, and a speaker with a coaxially mounted tweeter of smaller dimension can maintain wide dispersion to even higher frequencies.

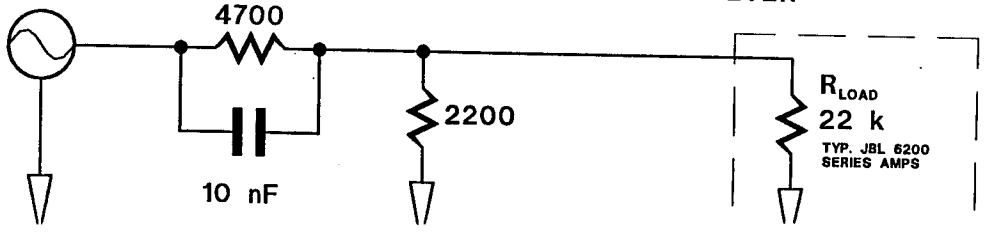


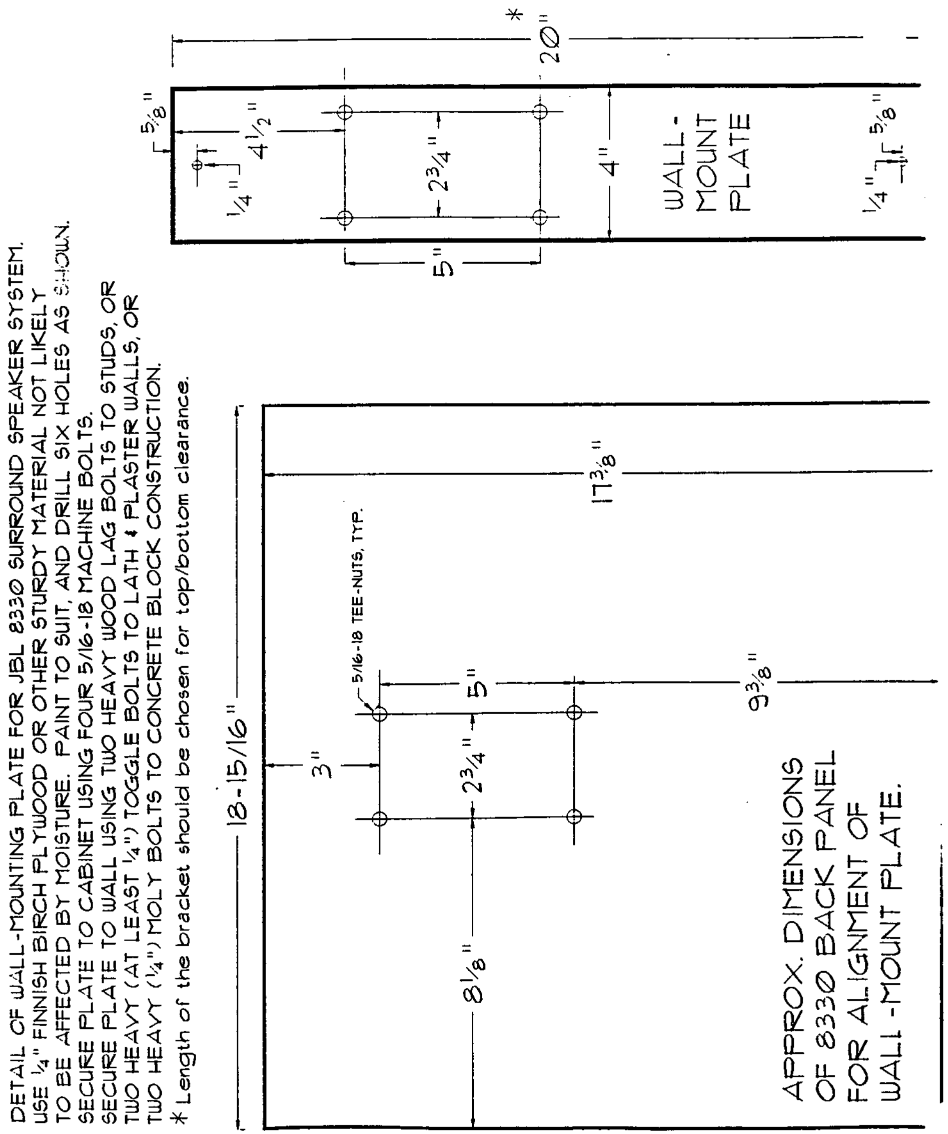
JBL 4660

BASIC VERTICAL DISPERSION PATTERN CHARACTERISTICS



SINGLE-ENDED IN-LINE BI-RADIAL™ TILT FILTER





BUILDING MATERIAL	2 kHz ABSORPTION COEFFICIEN
ACOUSTIC TILE, 5/8", most mountings	.70
AUDIENCE, occupied seating area	.80
BALCONY, opening, deep, w/plush seats	.5 - 1.00
BRICK WALL, painted	.02
BRICK WALL, unpainted	.05
CARPET, rubber on concrete	.03
CARPET, Astroturf on concrete	.20
CARPET, thin pile on concrete	.27
CARPET, thin pile w/pad on concrete	.50
CARPET, heavy, on concrete	.60
CARPET, heavy, w/pad on concrete	.71
CONCRETE, poured or terrazzo	.02
CONCRETE FLOOR w/linoleum	.03
CONCRETE BLOCK, painted	.09
CONCRETE BLOCK, coarse *(porous)*	.39
COTTON, 14 oz, draped to 7/8 its area	.37
COTTON, 14 oz, draped to 1/2 its area	.66
DRAPE, 18 oz velour, draped 7/8	.45
DRAPE, 18 oz velour, draped 1/2	.70
FIBERGLASS, mat faced, 1" thick	.94
GLASS, plate, large panes	.02
GLASS, common window	.07
GRAVEL SOIL, loose and moist, 4"	.75
GRAVEL SOIL, loose and moist, 12"	.80
GYPSUM sheet rock, 1/2" on 2x4s/16" centers	.07
INTERIOR STUCCO, smooth, on tile	.04
MARBLE	.01
OZITE, .39 lb/square foot	.47
PINE FLOORING	.09
PLASTER, on hollow tile	.04
PLASTER, smooth, on wire lath & studs	.04
PLASTER, rough, on wire lath & studs	.06
PLYWOOD, 1/8" on 2x4 studs	.08
PLYWOOD, 3/8" paneling	.10
SAND, dry, 4" depth	.55
SAND, dry, 12" depth	.60
STAGE, open, depending on furnishings	.25 -.75
SONEX	.99
TECTUM, 1" panels hung under plenum	.50
TECTUM, 1" panels on 1" furring strips	.60
THEATER SEATS, plush, on hard floor	.80
VENETIAN BLINDS, 45 degrees, @ 5"	.13
WATER, as on swimming pool	.02
WOOD, hardwood plain or parquet floor	.06

LITERS	=	FT^3	=	$INCH^3$	=	$METER^3$
.016387	=	.0005787	=	1.0	=	.0000164
1.00	=	.0353146	=	61.0	=	.001
28.32	=	1.00	=	1,728	=	.02832
1000.00	=	35.31	=	61,024	=	1.00

MILLIMETER	=	INCH	=	METE
1.00	=	.039	=	.0(
25.40	=	1.000	=	.02
1000.00	=	39.370	=	1

Sound Pressure dB SPL	Sound Pressure Pa	Sound Pressure bars	Intensity W/m^2	Air Particl Velocity
140	200 Pa	2 mbar	100 W	500 mm/
120	20 Pa	200 ubar	1 W	50 mm/
100	2 Pa	20 ubar	10 mW	5 mm/
80	200 mPa	2 ubar	100 uW	500 um/
60	20 mPa	200 nbar	1 uW	50 um/
40	2 mPa	20 nbar	10 nW	5 um/
20	200 uPa	2 nbar	100 pW	500 nm/
0	20 uPa	200 pbar	1 pW	50 nm/

note: 1 Pa (pascal) = 1 newton/m^2 20 uPa = 0.0002 dynes/c

SOUND WAVE LENGTH = velocity of sound divided by frequency (Hz)

FREQUENCY = velocity of sound divided by sound wavelength

SOUND VELOCITY = 344 m/s, 1130 ft/s or 13,560 in/s at 72 degrees F
" " = 342.5 m/s, 1125 ft/s, 13,500 in/s at 68 degrees F

AREA OF CIRCLE = 3.14 x (radius squared) [radius = 1/2 diameter

DIAMETER OF CIRCLE = 2 x [square root of (area/3.14)]

VOLUME OF TUBULAR DUCT = circular area x length

VOLUME OF TRIANGULAR BOX SECTION:
(1/2 base) x height x length

VOLUME DISPLACED BY CONE LOUDSPEAKERS:

10" drivers = .1 cubic foot
12" drivers = .15 cubic foot
15" drivers = .2 cubic foot
18" drivers = .3 cubic foot

LOUDSPEAKER MOUNTING HOLE AND BOLT CIRCLE DIMENSIONS:

	mounting holes:	bolt circles:
for 8" drivers =	7-1/16"	7-5/8"
for 10" drivers =	9"	9-3/4"
for 12" drivers =	11-1/16"	11-9/16"
for 15" drivers =	13-31/32"	14-9/16"
for 18" drivers =	16-13/16"	17-3/8"

MINIMUM POWERING REQUIREMENTS FOR LOUDSPEAKERS

People occasionally inquire about what minimum amplifier should work satisfactorily with a particular loudspeaker. To some, this question would seem strange, but upon review, even engineers may be reminded about the relationship of electrical power input to speaker loudnes

Reviewing some examples of typical loudness in daily experience:

0 dB = barely perceptible sound.
15 dB = recording studio silence level.
40 dB = residential area at night.
50 dB = average home or private office.
60 dB = face to face conversation.
70 dB = face to face heated debate.
80 dB = face to face shouting match.
90 dB = freeway traffic (moving).
100 dB = freeway traffic in tunnel.
110 dB = loud crowd in closed arena.
120 dB = jet takeoff at 100 meters.
130 dB = some permanent hearing loss.

1. **Find the loudspeaker's sensitivity rating (1 watt at 1 meter).**
2. **Find the distance from the speaker(s).**
3. **Determine the sound level requirement.**

The relationship between amplifier power and sound pressure is:

1 watt = 0 dB
2 watts = +3 dB
4 watts = +6 dB
10 watts = +10 dB (twice as loud as 1 watt)
20 watts = +13 dB
40 watts = +16 dB
100 watts = +20 dB (four times as loud as 1 watt)
200 watts = +23 dB
400 watts = +26 dB
1000 watts = +30 dB (eight times as loud as 1 watt)

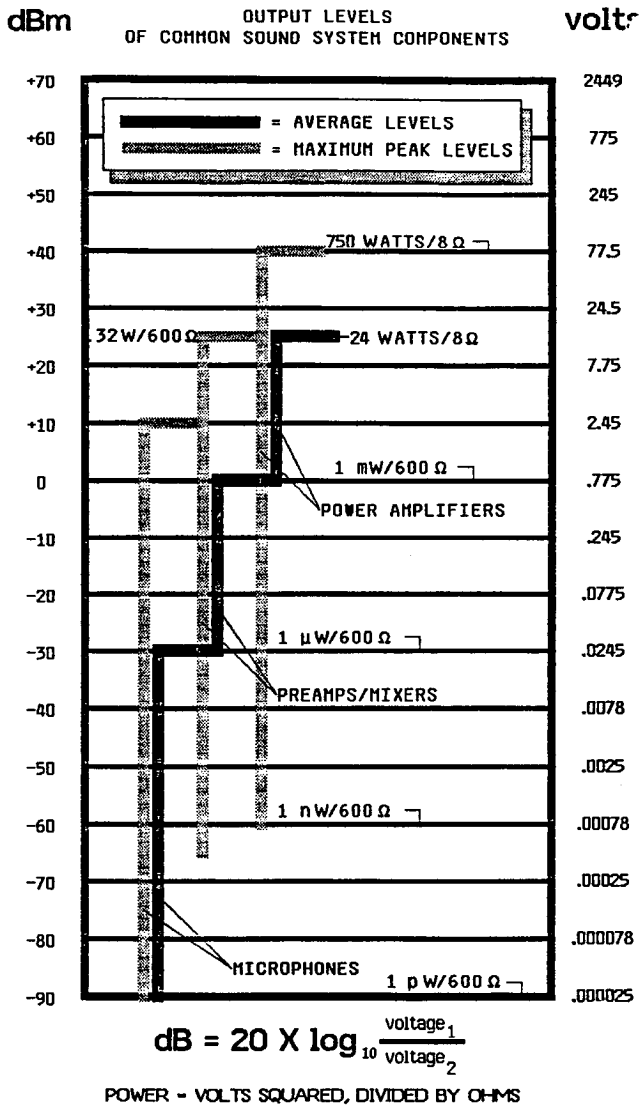
4. **Add the approximate number of dB to the sensitivity rating.**
5. **For a stereo set of speakers, add 3 dB to the rating.**

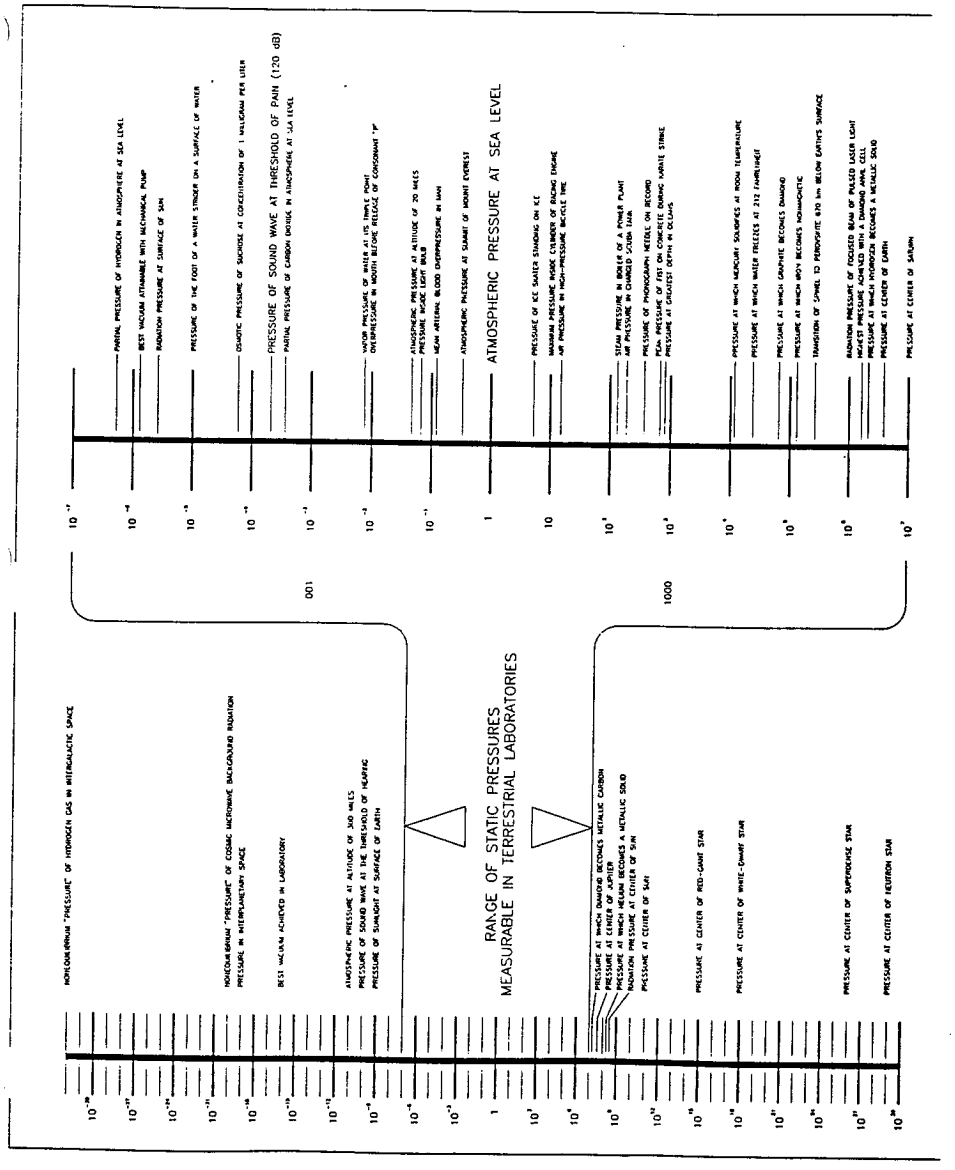
The relationship of distance to sound pressure in free space--outdoors--is as follows (in a room it will be louder):

1 meter = 0 dB
2 meters = -6 dB
3.2 meters = -10 dB (half as loud as 1 meter)
4 meters = -12 dB
6.3 meters = -16 dB
10 meters = -20 dB (one quarter as loud as 1 meter)
20 meters = -26 dB
32 meters = -30 dB (one eighth as loud as 1 meter)
40 meters = -32 dB
63 meters = -36 dB
100 meters = -40 dB (one sixteenth as loud as 1 meter)

6. **Subtract the approximate number of dB from the last figure obtained.**

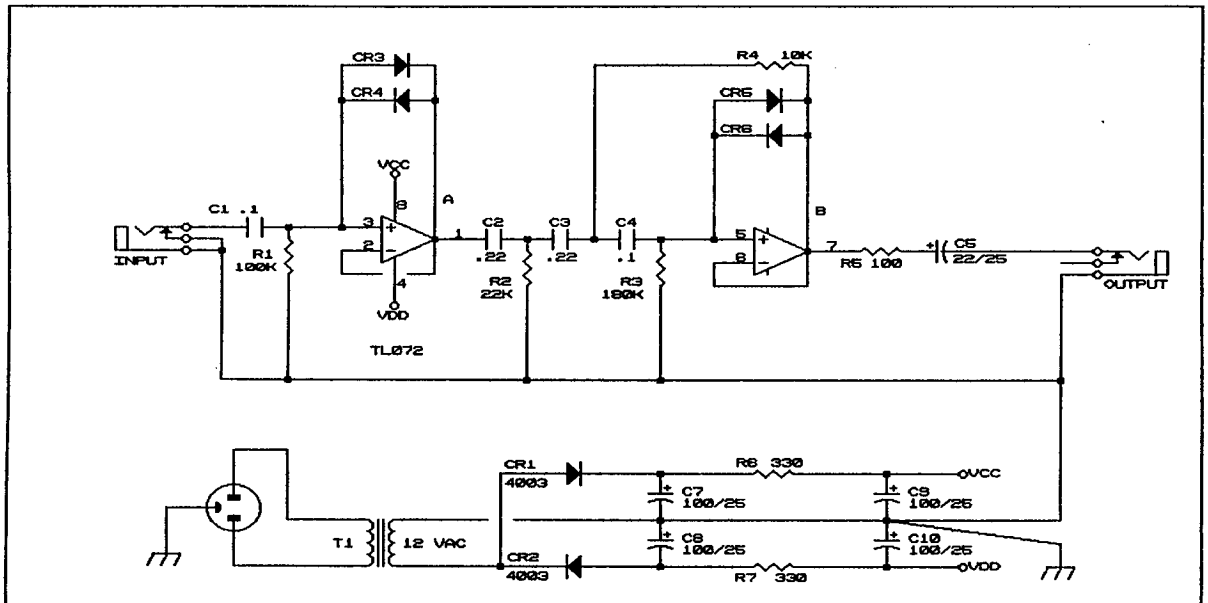
The result is now the minimum sound level developed by the particular speaker(s), with the power available, at the known distance.


dBm
OUTPUT LEVELS
OF COMMON SOUND SYSTEM COMPONENTS
volts
= AVERAGE LEVELS
= MAXIMUM PEAK LEVELS
750 WATTS/8Ω
32W/600Ω
24 WATTS/8Ω
1 mW/600Ω
POWER AMPLIFIERS
1 μW/600Ω
PREAMPS/MIXERS
1 nW/600Ω
MICROPHONES
1 pW/600Ω
+70
+60
+50
+40
+30
+20
+10
0
-10
-20
-30
-40
-50
-60
-70
-80
-90
2449
775
245
77.5
24.5
7.75
2.45
.775
.245
.0775
.0245
.0078
.0025
.00078
.00025
.000078
.000025
dB = 20 X log 10 voltage1 / voltage2
POWER = VOLTS SQUARED, DIVIDED BY OHMS


PRESSURE OF SOUND WAVE AT THRESHOLD OF PAIN (120 dB)
ATMOSPHERIC PRESSURE AT SEA LEVEL
RANGE OF STATIC PRESSURES
MEASURABLE IN TERRESTRIAL LABORATORIES

COUNTRY	VOLTAGE(S)	FREQUENCY(S)
ALGERIA	127, 220	50 Hz
ARGENTINA	220	50
AUSTRALIA	220	50
AUSTRIA	230, 240	50
BELGIUM	110, 127, 220	50
BRAZIL	110, 115, 125, 220, 227	50, 60
CANADA	110, 115, 120	60
CHILE	220, (110)	50, (60)
CHINA	110, 220	50, 60
COLOMBIA	110, 115, 120	60
COSTA RICA	120	60
CUBA	110	60
CZECHOSLOVAKIA	220	50
DENMARK	220	50
DOMINICA	110	60
EQUADOR	110, 120, 127	60
EGYPT	110, 220	50
EL SALVADOR	110	60
ENGLAND	200, 210, 230, 240	50
FINLAND	220	50
FRANCE	110, 115, 120, 127, 220	50
GERMANY	110, 120, 127, 220	50
GUATEMALA	120, (220)	60
HAITI	115, (220)	60, (50)
HONDURAS	110	60
HUNGARY	220	50
INDIA	230	50
INDONESIA	110, 117	50
IRAN	220	50
IRAQ	220	50
ISRAEL	230	50
ITALY	110, 120, 127, 150, 160, 220	50
JAM[illegible]	110	50
JAP[illegible]	100	50, 60

COUNTRY	VOLTAGE(S)	FREQUENCY(S)
KOREA	100	60 Hz
LEBANON	110, 220	50
LUXEMBOURG	110, 220	50
MALAYA	230	50
MEXICO	120, 127	50, 60
MONACO	220	50
MOROCCO	115, 127, 220	50
NETHERLANDS	127, 220	50
NEW ZEALAND	230	50
NICARAGUA	120	60
NIGERIA	230	50
NORWAY	220	50
OKINAWA	100	60
PAKISTAN	220, 230	50
PANAMA	110, 115, 120	60
PERU	200, (110)	60, (50)
PHILIPPINES	110, 220	60
POLAND	220	50
PORTUGAL	120, 220	50
RUMANIA	220. (110)	50
SAUDI ARABIA	120, 230	50, 60
SIERRA LEONE	230	50
SOVIET UNION	127	50, (45)
SPAIN	120, 127	50
SWEDEN	220, (117)	50
SWITZERLAND	220	50
SYRIA	115, 200	50
TAIWAN	110	60
THAILAND	220	50
TUNISIA	110, 115, 220	50
TURKEY	110, 220	50
URUGUAY	220	50
U.S.A.	115, 120	60
VENEZUELA	[illegible]	[illegible]

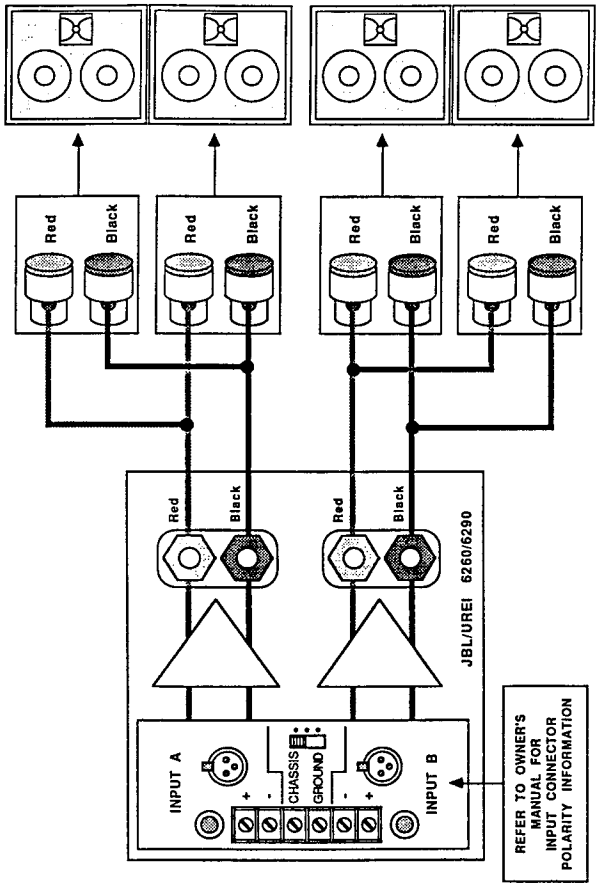


NOTES:

CR3 - CR8: 1N914
RESISTOR VALUES +/- 5% 1/2 W
CAPACITOR VALUES IN MICROFARADS
TO SHIFT F3 DOWN, INCREMENT THE VALUES OF R1, R2, R3 AND R4 UP BY THE SAME PERCENTAGE AS THE DIFFERENCE IN FREQUENCY. (150k, 33k, 270k, AND 15k FOR F3 OF 30 Hz.

	JBL/UREI ELECTRONICS
Title	30 Hz HIGH PASS FILTER
Size A	Document Number 092688A
Date: September 27, 1988	Sheet 1 c

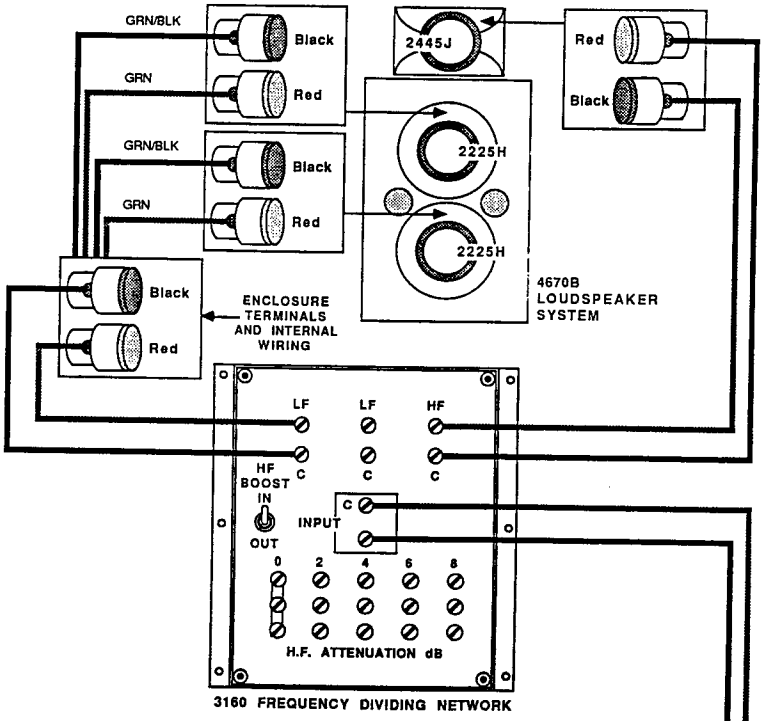
4612OK WIRING CONVENTION FOR ABSOLUTE POLARITY



ABSOLUTE POLARITY

A POSITIVE-GOING SIGNAL APPLIED TO THE "+" INPUT TERMINAL OF THE 6260/6290 POWER AMPLIFIER WILL RESULT IN FORWARD LOUDSPEAKER DIAPHRAGM MOVEMENT

4670B WIRING CONVENTION FOR ABSOLUTE POLARITY



NOTE

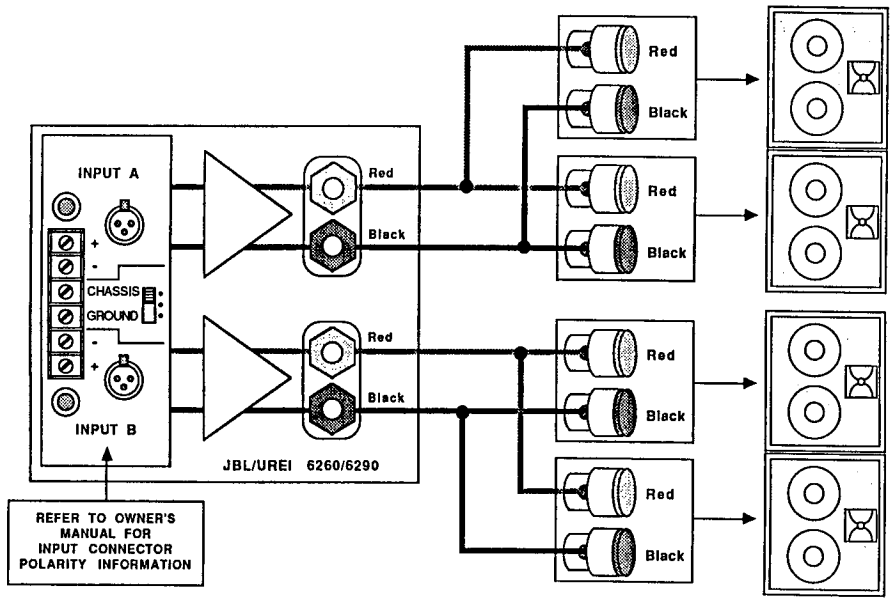
OBSERVE POWER AMPLIFIER INPUT POLARITY INSTRUCTIONS

NON-INVERTING POWER AMPLIFIER OUTPUT TERMINALS [e.g. JBL/UREI 6260/6290]

ABSOLUTE POLARITY

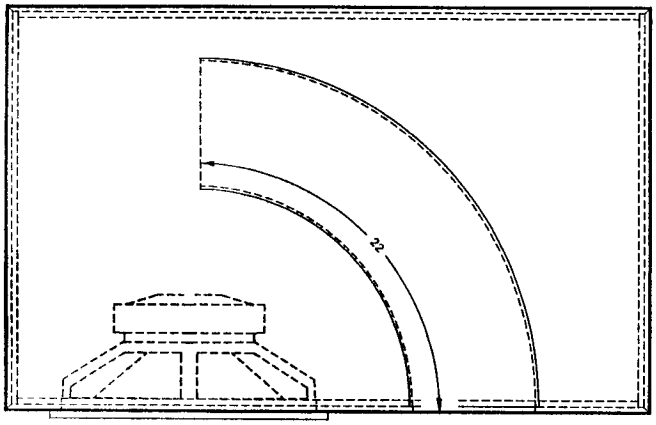
A POSITIVE-GOING SIGNAL **APPLIED TO THE** "+" INPUT TERMINAL OF THE 6260/6290 POWER **AMPLIFIER WILL** RESULT IN FORWARD LOUDSPEAKER **DIAPHRAGM** MOVEMENT

4612OK WIRING CONVENTION FOR ABSOLUTE POLARITY



ABSOLUTE POLARITY

A POSITIVE-GOING SIGNAL APPLIED TO THE "+" INPUT TERMINAL OF THE 6260/6290 POWER AMPLIFIER WILL RESULT IN FORWARD LOUDSPEAKER DIAPHRAGM MOVEMENT



VENTED ENCLOSURE FOR JBL 2245H SUBWOOFER DRIVER

NOTES:

1. APPLY 2X4 BRACING TO ALL PANEL INTERIOR SURFACES. ONE-HALF CUBIC FOOT HAS BEEN ALLOWED FOR BRACING VOLUME.

2. APPLY R25 OR R30 FIBERGLASS PADDING TO ALL INTERIOR SURFACES.

3. EDGE CONSTRUCTION SHOWN IS EXAMPLE; OTHER METHODS MAY BE USED AS NEEDED, AS LONG AS JOINTS ARE AIR-TIGHT.

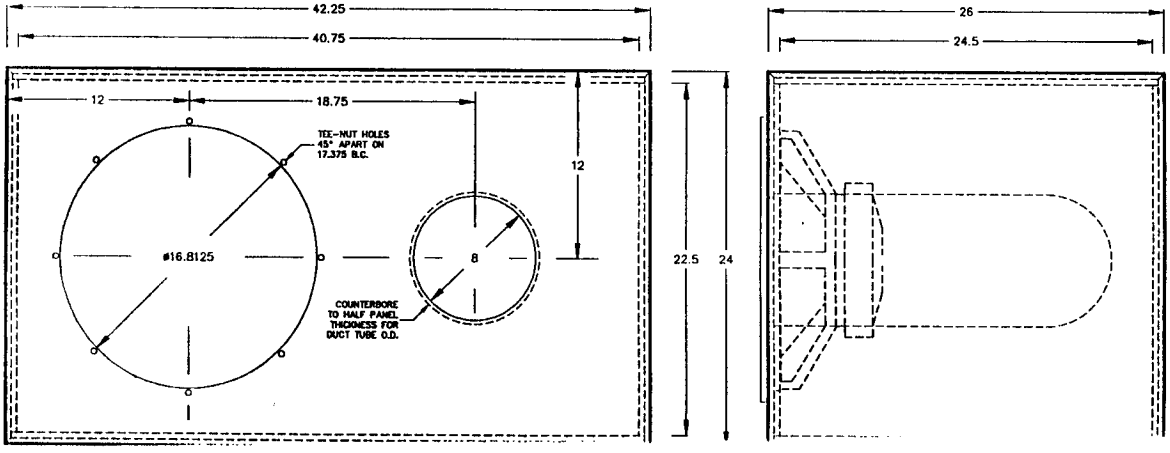
4. USE ONLY VOID-FREE, HIGH DENSITY MATERIAL FOR PANELS.

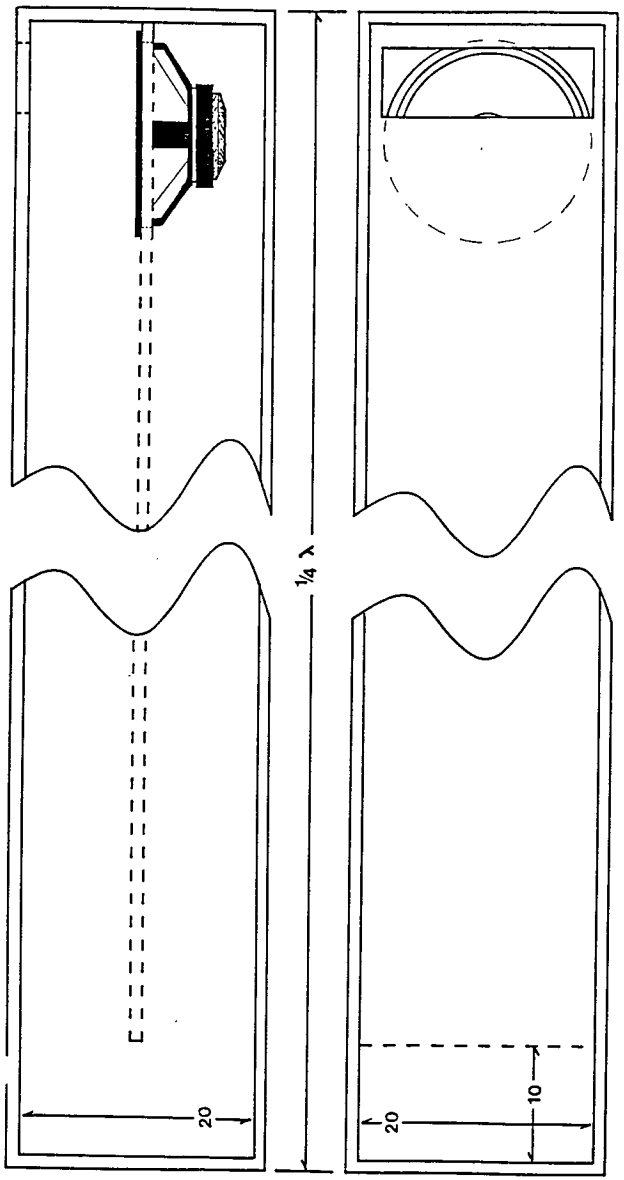
5. USE OF ALIPHATIC RESIN WOOD GLUE IS STRONGLY RECOMMENDED.

6. DUCT TUBE LENGTH (22 INCHES) IS MEASURED THROUGH CENTER FOR NON-ASSISTED 25 Hz BOX TUNING OR IS MEASURED THROUGH INSIDE OF BEND FOR 6th-ORDER (FILTER ASSISTED) 20 Hz BOX TUNING USING A HIGH-PASS FILTER WITH 20 Hz CENTER FREQUENCY AND A "Q" OF 2.0

7. SECURE CHICKEN WIRE TO INSIDE END OF DUCT TUBE TO PREVENT SMALL ANIMALS OR PETS FROM BEING TRAPPED INSIDE ENCLOSURE.

8. ADJUST OUTER BOX DIMENSIONS FOR MATERIAL THICKNESS USED. MATERIAL SHOWN IS 3/4", WHICH, WHEN PROPERLY BRACED, SHOULD BE ADEQUATE TO PREVENT ANY PANEL VIBRATION WHICH MAY WASTE ENERGY AND CAUSE ABBERANT FREQUENCY RESPONSE FROM THE SYSTEM.





NOTES: The air coupler is essentially an organ pipe driven by a loudspeaker. Its strong suit is producing high output near a single center frequency and the octaves immediately above and below that frequency. Output level and output bandwidth are inversely proportional and are controlled by varying the opening size. Larger openings yield greater output level but narrower bandwidth, while smaller openings give somewhat wider bandwidth at the expense of output level. The opening shown is 6 x 18 inches. Some experimentation will be needed when any driver or box length changes are made. A sliding port cover for the opening can be used to ascertain best system tuning. Box length depends on the desired center frequency, where gr[illegible] test output occurs, and is given by the f[illegible]la: Box Le[illegible] = 282/frequency. The finished box sho[illegible] be made very rigid and free of air leaks. The JBL 22[illegible] is recommended as the driver for the Air Coupler. Reference[illegible]

NOTES ON 70-VOLT AND DISTRIBUTED SYSTEM PRESENTATION

by Drew Daniels
NSCA, SEPTEMBER 10, 1985

The so-called 70 volt line distributed loudspeaker system wiring scheme offers a flexible means of operating multiple loudspeakers connected to singular amplifier lines.

The definition of the "70 volt" system is one in which 70 volts (70.7 volts) represents the maximum operating VOLTAGE delivered from the driving amplifier, regardless of the particular power level capability of that amplifier. A "70 volt" speaker transformer with power level taps of 1, 2, and 4 watts, will draw 1, 2, or 4 watts, depending on the tap selection, when the line voltage fed to the transformer's primary reaches 70.7 volts.

The 70 volt and other constant voltage (e.g. 25 volt, 50 volt, 140 volt) systems were devised to provide an economical means of driving many speakers over long signal lines with low loss. Higher voltage on the line allows use of less current in the wire, which in turn causes less voltage drop and power loss in the wire itself and allows use of smaller less expensive wiring.

It is not necessary to achieve 70 volts in the speaker lines to successfully operate a 70 volt system, but following the same logic that applies to any amp and speaker combination, the square of the voltage divided by the number of ohms representing the total system load will determine how much power will actually be distributed through the system.

An analogy of distributed system operation can be made from everyday house wiring to illustrate how a distributed system works: in a house there is an electrical conduit carrying 120 volts all over the house to wall outlets. A 20-amp circuit breaker feeds the line. At any outlet you can plug in a lamp to give you as much light as you need in that particular location, however, since the line is supplied by a 20 amp breaker, you can only plug in 2400 watts (120 volts X 20 amps) of total load before you run out of power and trip the circuit breaker. You can use twenty-four 100-watt lamps or fourty-eight 50-watt lamps or a hundred 24-watt lamps and so on, to use all of the available power, but you might also only use one lamp in each room drawing only a few hundred total watts, which will leave power to spare. The distributed system is a constant voltage system.

An amplifier capable of developing 70 volts into a load of 8 ohms can be used to provide 600 watts in a 70 volt system. This much power might be used to drive 200 ceiling speakers each with their transformer taps set to 3 watts, or half of all the speakers set to 4 watts and half set to 2 watts to create a loud zone-quiet zone arrangement where the two zones differ in sound level by 3 dB (3 dB is half/twice power and a just noticeable difference in speech sound level).

Substituting an amplifier with a maximum 50-volt / 4-ohm (600 watts) load capability rating and doing nothing else, would drop the available power to this system to 300 watts and provide each speaker in the system with half the power indicated by its transformer tap setting. Since this substitute amplifier is rated to drive a 4-ohm load where the original amplifier was rated at 8 ohms, another 200 speakers--a doubling of the original number--could be added to the system and would be driven at the same power level as the original 200 units, or half the rated tap setting value, allowing the full 600 watt potential of the substitute amplifier to be realized.

The Ohm's Law-based equations provide an easy way to determine just how much voltage, current or power is involved in particular system designs or what the total loading on a distributed line will be based on the wattage taps used and number of speakers connected to the line. JBL tech note, Volume 1, Number 2: "70-volt Distribution Systems Using JBL Industrial Series Loudspeakers," gives tables and other valuable information to aid in distributed system design.

Loudspeaker sensitivity and impedance rating play a big part in overall system efficiency. Speakers of different impedances draw different amounts of power from a constant voltage (e.g. the 70 volt system) source. For example, let's use two commercially available speakers, A and B. The pertinent specifications of the two devices are as follows:

SPEAKER A: Sensitivity = 97 dB SPL, 1 W, 1 m and impedance = 8 ohms.

SPEAKER B: Sensitivity = 86.5 dB SPL, 1W, 1m and impedance = 6 ohms.

Speaker transformers have insertion loss that is due mostly to resistive losses in the transformer, so the transformer loss itself can be calculated as if the loss element is a resistor. If we know that some typical transformer has one dB of insertion loss when working into its rated load impedance (usually 8 ohms), then we can calculate backwards and find the transformer's equivalent resistance to be 2 ohms. We know this from the fact that a transformer that has 1 dB of loss delivers 4 watts to a speaker when its 5-watt tap is used.

A speaker with lower impedance will draw more power from a constant voltage source, and if the source had negligible resistance itself, then the 4 watts available to the 8-ohm speaker A would become 5.3 watts but it's not quite that simple. If we place speaker A in a series circuit with our typical transformer, we find that the speaker drops 4 watts and the transformer drops 1 watt to make up the 5-watt total. The current across this combination is 0.707 ampere, which means the voltage drop across the 10-ohm load (8 ohms for the speaker and 2 ohms for the transformer's resistive loss) is 7.07 volts.

Substituting speaker B across the same constant voltage produces 0.884 ampere of current through the load (now 8 ohms total), and causes 1.56 watts to be lost in the transformer and 4.69 watts to be delivered to the speaker.

The difference between the 4.69 watts for speaker B and the 4 watts for speaker A is only a little over one-half dB. What might have seemed to be a potential advantage is eaten up by the transformer, and worse, the lower impedance speaker B is now pulling 6.25 watts from the line, which is 25% more power and will mean that you can only connect 80% of the number of speaker A you would have been able to connect to the line before you exceed the amplifier's available power.

The issue of speaker sensitivity is much more important when many speakers are used and the "dBs for dollars" problem can eat up profits quickly. Speaker A offers 97 dB SPL for 1 watt at the standard 1 meter distance. Speaker B offers 86.5 dB SPL for the same watt. This means that to achieve the same sound level at the same distance, speaker B will require more than 10 times more power than speaker A. Another way to look at it might be that it will require at least 3 times as many of speaker B to provide the same sound level as speaker A, and in some physical situations up to 10 times as many of speaker B.

OHM'S LAW-DERIVED EQUATIONS

TO FIND WATTS	TO FIND AMPS:
(volts squared) divided by ohms	volts divided by ohms
(amps squared) X ohms	watts divided by volts
volts X amps	square root of (watts divided by ohms)

TO FIND OHMS:	TO FIND VOLTS:
volts divided by amps	amps X ohms
(volts squared) divided by watts	watts divided by amps
watts divided by (amps squared)	square root of (watts X ohms)

JBL AMPLIFIER / AUTOFORMER OUTPUT CHARACTERISTICS

JBL Amplifier Model	Stereo Voltage Output	Bridged Voltage Output	Maximum Power/ Channel	Maximum Power/ Mono Bridge
6210/6211	17 VAC	-------	45 W	------
6215	17 VAC	27 VAC	45 W	90 W
6230	25 VAC	50 VAC	150 W	300 W
6260	35 VAC	70 VAC	300 W	600 W
6290	50 VAC	100 VAC	600 W	1200 W

JBL 70 volt[1]

Autoformer/ Transformer #	Input Impedance	70 volt Output	Impedance Matching*	Impedance Ratio
6237	*4 ohms*	*150 W*	*6 ohms*	*1:9*
6267	*4 ohms*	*300 W*	*6 ohms*	*1:4*
6297	*4 ohms*	*600 W*	*8 ohms*	*1:2*
6218	4 ohms	45 W	112 ohms	1:28
6238	4 ohms	150 W	36 ohms	1:9
6268	4 ohms	300 W	16 ohms	1:4
6298	4 ohms	600 W	8 ohms	1:2

**can be used for step up or down.*

JBL AUTOFORMER/TRANSFORMER SPECIFICATIONS

Frequency Response : +,- 0.5 dB, 25 Hz to 20 kHz
THD : Less than 0.5 % , 25 Hz-20 kHz at rated power.
Insertion Loss : Less than 0.75 dB
Connections : Screw/Solder Lugs
Mounting : Mounting Brackets Attached

Model	Power	H	W	D	Weight	Shipping Weight
6237	150 W	4	3.25	3.5	7	8
6267	300 W	4.5	3.5	3.75	9	10
6297	600 W	4.5	3.75	3.75	10	11

[1] Italics indicate Autotransformer

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TECHNICAL NOTES INDEX

Technical Notes Vol. 2, No. 1A	1/3 Octave Equalization and the JBL/UREI 5547A and 5549A
Technical Notes Vol. 2, No. 2	JBL/UREI Power Amplifier Design Philosophy
Technical Notes Vol. 2, No. 3	Applications for the JBL/UREI 7922 Digital Audio Delay
Technical Note/Danger: Low Power	
Marketing White Paper	The Relationship Between the Sound Contractor and Religious Organizations

CONDENSED GLOSSARY OF AUDIO TERMS

by Drew Daniels

- A -

ABSORPTION
The ability of a material to absorb sound energy and reduce sound intensity by converting sound (vibration in air) to heat by means of friction in the material's structure (adiabatic heating).

ABSORPTION COEFFICIENT
The efficiency of a material to absorb sound at a particular frequency (which relates to sound wave length and material thickness). An absorption coefficient of 1.00 indicates total absorption, while a coefficient of 0.00 indicates total reflection. (see also, SABIN)

ACOUSTIC
Related to pressure changes or propagating mechanical waves in air or any other sound transmission medium, that comprise sound in its conventional form, as humans hear it.

ALNICO
An alloy of cobalt, nickel and aluminum used as permanent magnet material in magnetic structures of loudspeakers and microphones. In the early 1980's, alnico was largely supplanted in favor of ferrite in loudspeaker design because of political upheavals in the african countries that produce cobalt, the prime constituent of alnico.

AMBIENCE
The distinctive acoustical characteristic of a room or acoustic space due to the many sound reflections in the space. For example, rooms that are said to be acoustically "dead" lack ambience.

AMPERE
The ampere is that constant current which, if maintained in two straight parallel conductors of infinite length, of negligible circular cross section, and placed 1 meter apart in vacuum, would produce between these conductors a force equal to $2X10^{-7}$ (0.0000002) newton per meter of length.

AMPLIFICATION
An increase in signal quantity of either amplitude or power level.

AMPLIFIER
A device which increases the voltage and/or power level of signals fed through it.

AMPLITUDE
The extreme range of a fluctuating quantity, as an alternating current, swing of a pendulum, etc., generally measured from the average or mean to the extreme.

ATTACK
The beginning of a sound or the initial transient of a musical note.

ATTENUATE
Reduce. In audio parlance, to reduce the level of an electrical signal as with a volume control, pot (potentiometer), fader or pad.

AUDIO FREQUENCY
Any frequency which humans hear, typically between a lower limit of about 12 hertz and an upper limit of about 20,000 hertz. This range of audio frequencies is also known as the "audio spectrum."

AUTOFORMER—AUTOTRANSFORMER
A single-winding coil, often on a magnetic core, resembling a transformer in physical appearance. When used for audio, the autoformer is fed a high-level signal such as that from a loudspeaker line, and produces desired changes in voltage at one or more taps along the coil's length. These taps are usually spaced so as to produce specific impedance ratios between inputs and outputs. For example, a 1:2 autoformer connected to an 8-ohm loudspeaker will convert its impedance to either 4 ohms or 16 ohms, depending on which way the connections are made.

AXIS
An imaginary center point. Looking down the center of a horn places the viewer "on axis" to the horn, while moving to the side so that the horn throat is not visible places the viewer "off axis."

- B -

BAFFLE—ACOUSTIC
An absorptive board or sound barricade that can be placed around or between acoustic sources to provide sound isolation or deadening and reduce acoustic leakage between multiple microphones, such as in a recording studio or live musical performance stage setup.

BAFFLE—SPEAKER
The enclosure surface, wall boundary or mounting board on which loudspeaker drivers are mounted.

BALANCED—BALANCED LINE
(see FLOATING)

BAND
In terms of audio frequency, a band is a portion of the audio frequency spectrum in the same way that green is a portion of the visible frequency spectrum. The audio frequency spectrum covers a range of over 10 octaves. The visible light frequency spectrum covers a range of less than 1 octave.

BAND PASS
A set of two filters that attenuate frequencies beyond the frequency limits of a given band of frequencies. The telephone, for example, is a band pass filter that eliminates low frequencies below about 300 hertz and high frequencies above about 5,000 hertz, causing the characteristic telephone sound most people are familiar with.

BAUD
The rate or frequency of data bit or byte transmission in a data transmission line.

BUS or BUSS
Like a bus that may carry many passengers, an audio bus is a wire or circuit that may carry more than one audio signal at a time.

- C -

CAPACITOR
An electronic circuit component part designed to store electricity. The value of such a part in farads (F) is a measure of the amount of electricity that can be stored. A theoretically ideal capacitor with a one-farad capacity is charged, from a discharged state, to a voltage of one volt, by applying a current of one ampere for a period of one second. Capacitors are made of two metal conductors separated by a non-conducting dielectric material such as paper, oil, glass, air, mylar, polypropylene, polystyrene, etc.

CARDIOID
Heart-shaped. Pronounced "car-dee-oid," in terms of microphones, refers to the relative sensitivity of the microphone with respect to the angle from which sound strikes the front (on-axis). Cardioid microphones decrease gradually in sensitivity as they are rotated away from the source of sound they are aimed at. Cardioids perform best if their off-axis frequency response is similar to their on-axis response.

CENTER FREQUENCY
The particular frequency at which the most boost or cut is available in a peak-dip type equalizer such as a graphic type, or a notch filter or parametric type.

CHANNEL
The individual audio signal path through a system which has more than one such path or as in the case of a single-channel amplifier a device which passes signals along only one electrical path.

CLIPPING
A distortion of audio signals caused by input signal peaks or voltage amplitudes which cause a circuit to attempt to exceed its own maximum voltage capabilities.

COMPRESSOR
An audio amplifier whose output amplification rate of change is less than its input signal amplitude rate of change. Compressors are used to reduce the dynamic range of program signal either to make everything sound louder, or to automatically control sudden large changes in signal amplitude as in the case of recording vocalists. Compressors sometimes include circuits that allow the user to adjust the time it takes to start compressing (attack), to ease up on the compression (release), and also the input and output gain. (see also, LIMITER)

COMPRESSION DRIVER
A loudspeaker designed specifically to drive a horn, matching the horn's acoustic impedance to achieve higher efficiency.

CONDENSER
(see CAPACITOR)

CORNER FREQUENCY
The frequency that defines the lower or upper limit of an audio frequency band, and where the power level is half of that in the middle of the band or "center frequency."

COULOMB
The coulomb is the quantity of electricity transported in 1 second by the current of 1 ampere.

CROSSOVER—ACTIVE, or ELECTRONIC
An electronic device which filters and selectively amplifies frequencies, separating the frequencies into sections or bands, and routing them to outputs designed to drive power amplifiers and in turn, speakers. The frequencies filtered depend on the electrical value of the component parts in the circuits of the device, but not on the source or load impedances connected to the device, except in the case where the crossover is actually a

passive crossover designed for insertion in the medium-level signal lines of an audio system rather than in speaker lines.

CROSSOVER—PASSIVE, or HIGH-LEVEL
An electrical device composed of coils of wire (inductors) and electrical capacitors, that separates audio frequency bands by filtering action and routes them to different places (such as a woofer and a tweeter). The frequency of the crossover's action is determined by the value of the electronic components inside, and by the loudspeaker driver's impedance in ohms, which implies that replacing a 16-ohm driver in a particular system with an 8-ohm driver, will change the crossover frequency; in such a case, the frequency will rise an octave and the shape of the crossover frequency response slopes will be distorted.

CROSSTALK
The leakage between audio signal carrying channels, typically heard as bleed-over between left and right stereo speakers, or as leakage of high-frequency sound between busses or circuits in audio mixers, microphone cable snakes, and multiple circuit audio signal wiring. Crosstalk is often caused by the electrical coupling by capacitance between the metal traces on printed circuit boards or the proximity of conductors in mixer wiring harnesses.

CUE
Also called "foldback," cue is a portion of audio signal in a system which is diverted and used for pitch and tempo reference by musicians or for timing reference by voiceover announcers for jingle production and motion picture dialog replacement dubbing (as from monitor speakers or headphones). The term "cue" is also used to describe the circuits within an audio mixer unit or an audio system designed to provide this reference.

CUTOFF FREQUENCY
All audio systems are limited to a band of frequencies in which they can do useful work. The frequencies are defined as the corner frequencies of a filter. Since for example, an amplifier cannot reproduce infinitely high notes, it is a low-pass filter whose cutoff frequency is the point (in hertz) where it can no longer produce full-power output, and where the actual output power falls to half the midband power or 3 decibels below the reference full- power output at midband (-3 dB point).

- D -

DAMPING or DAMPING FACTOR
The difference or ratio of an amplifier's output impedance and the impedance of the driven load. For example, an amplifier whose output impedance is 0.8 ohm driving a speaker whose impedance is 8 ohms has a damping factor of 10, while an amplifier whose output impedance is 0.08 ohm driving an 8-ohm speaker gives a damping factor of 100. Inserting a speaker cable whose resistance is .08 ohms in series with an 8-ohm speaker and an amplifier with a .08-ohm output impedance lowers the overall system damping factor to 50 (8 divided by .16).

DECIBEL or dB
A comparison of two similar values, like apples vs. apples, oranges vs. oranges or volts vs. volts. A voltage doubling (or halving) produces a 6 dB increase (or decrease), and a power doubling (or halving) produces a 3 dB increase (or decrease). The amount of power increase required for us to hear a twice-as-loud increase is +10 dB. The amount of power decrease it takes for us to hear a half-as-loud decrease is -10 dB. Thus to produce sound twice as loud as that produced by a 100-watt amplifier would require a 1,000-watt amplifier.

The dB is a power ratio. Calculating dB for power is done by multiplying the difference between two numbers by 10 times the base-10 logarithm of the numerical ratio.
For example:

50 watts = $10\text{Log}_{10}(50/1)$ = 16.99 dBW or 16.99 dB above one watt.

Quantities that are calculated using $10\log_{10}$ are:

Watts	Energy level
Illuminance	Intensity level
Power level	Energy density level

Quantities that are not power ratios must be calculated using $10\log_{20}$ as the multiplier. These include:

Volts	Vibratory acceleration
Amperes	Vibratory velocity
Sound pressure level	Vibratory force

VOLTS	dBV	dBu	WATTS	dBm	dBW
.02449	-32.2	-30	.0001	-10	40
.03162	-30	-27.8	.001	0	-30
.07746	-22.2	-20	.002	3	-27
.1	-20	-17.8	.01	10	-20
.24495	-12.2	-10	.1	20	-10
.31623	-10	-7.8	1	30	0
.77459	-2.2	0	10	40	10
1.0	0	2.2	100	50	20
10.0	20	22.2	1000	60	30

There are several significant decibel variations used in audio:

dB	- used alone as reference for level changes.
dBV	- ratio of volts referred to one volt.
dBu	- ratio of volts referred to 0.7746 volt.
dBm	- ratio of watts referred to one milliwatt.
dBW	- ratio of watts referred to one watt.
dB SPL	- ratio of sound pressures referred to 20 micropascals.

NOTE: dBm should not be use to denote a voltage, since that implies that a specific load impedance is known. dBm improperly used where dBu should be used must, therefor, include a statement of circuit dependency on a 600-ohm load, since dBm and dBu are equal only if the 1 mW dBm reference is driving a 600-ohm load:

watts = volts²/ohms, ∴ 0.7746 volt² = 0.6/600 ohms = 0.001 watt

DECAY
The fading away of a musical note after its onset or attack. In acoustics, the time it takes for echoes and reverberation to fade away. The term "RT_{60}" is used to describe the reverberation time of a room or acoustical space under study when a period of time has elapsed after a calibrated noise excitation is stopped, until the reverberation in the room drops to a sound pressure level 60 dB below the reference level of the excitation. RT_{60} values of 5– 10 seconds are typical of large cathedrals. RT_{60} between 1–5 seconds are typical of churches or gymnasiums and RT_{60} values between .1 and 1 second are typical of recording studios.

DIAPHRAGM
The moving part of a loudspeaker, particularly compression drivers and tweeters. The part of a loudspeaker that actually pushes on the air causing air motion.

DIFFRACTION

The phenomenon of sound waves bending around objects which are small compared to the length of the waves (see WAVELENGTH). Objects such as posts tend not to affect bass sounds but will shadow higher pitches (frequencies) to the extent that listeners will not hear tweeters that are not visible from their listening position.

DISPERSION
The directional pattern of sound radiation from a loudspeaker. The dispersion of horns is controlled by the horn's mouth walls, the overall size of the mouth and the length of sound waves emanating from the mouth. Low frequency loudspeakers normally radiate omnidirectionally at low frequencies, gradually forming beams of sound as frequency rises and sound wavelength becomes a smaller fraction of the loudspeaker's diameter. (see WAVELENGTH)

DISTORTION
An alteration in the shape, voltage, phase, timing relationships and frequency response of an audio signal caused either intentionally or unintentionally by circuitry that is driven to overload, or by poorly designed audio components such as microphones, mixers, effects, crossovers, amplifiers or speakers which do not accurately reproduce signals fed through them. (see OVERLOAD)

DIRECTIVITY
Directivity is a measure of the output of loudspeakers or horns based on the included angle within which the sound pressure level drops no more than 6 dB (one-quarter power). For example, a horn which covers a horizontal angle of 90 degrees (a quarter circle) where the two 45 degree off-axis points are 6 dB quieter than the on-axis measurement is said to have a (horizontal) "Q" of four, because it directs sound from what would have been an omnidirectional radiator (the horn's driver) into a quarter circle. Vertical directivity is derived in the same manner as is horizontal directivity, but the two figures are usually printed as two separate pieces of information on horn specification sheets since most horns radiate into different horizontal and vertical angles. A horn whose output covers angles of 90 degrees both horizontally and vertically, or one-quarter of a sphere, is said to have a total Q of 4, and a DI (Directivity Index) of 6 dB, since the same acoustical power from an omnidirectional radiator, forced to radiate into a quarter-sphere, is 6 dB louder at the same distance from the source than it would be radiating omnidirectionally, producing four times the apparent acoustical power to an observer such as a measurement microphone.

DIVIDING NETWORK
(see CROSSOVER)

DOPPLER EFFECT
For sound in air, the Doppler Effect takes the form of a shift in pitch which is proportional to the speed of any movement between a sound source and a listener such as the shift in the whistle on a passing train or the bells on a passing ice cream truck. In the same manner, a loudspeaker cone reproducing bass frequencies with their attendant long cone excursions will add a vibrato to any high-frequency tones being simultaneously reproduced by the same cone. The vibrato's rate will be that of the frequency of the lower reproduced pitch or pitches, and the vibrato depth will depend on the particular pitches that are interacting and the amplitude of low-frequency cone excursions. This vibrato is also called Doppler distortion, and is cited as one of a number of compelling arguments in favor of multi-way speaker systems.

DRIVER
Another name for loudspeaker; the word "driver" is used by non-engineers to designate a compression driver like those used to drive horns for acoustic amplification and directional control of sound.

DRY
An audio signal or sound without reverberation. An audio signal or sound with reverb is called "wet."

DUCT or DUCTED PORT
A tube attached to a speaker enclosure to "tune" and define the lowest usable frequencies of the enclosure. Like a bottleneck, a duct produces one distinct tuned pitch determined by its size relative to enclosure size. Such tuning is virtually independent of the bass driver mounted in the box, but grossly affects performance both in terms of frequency response and distortion.

DYNAMIC RANGE
The difference, in decibels, between the loudest and the quietest passages in a musical or audio program. Also, the difference between the maximum signal level that can be produced under nominal operating distortion levels by an electronic circuit, and that circuit's obnoxious noise level (called the "noise floor").

DYNE (per square centimeter)
An obsolete term used to designate 0.1 pascal, or 74 dB SPL (Sound Pressure Level). Also a unit of pressure equal to 0.1 newton per square meter. (see SPL chart on last page)

- E -

ECHO
Any or all audibly discrete delayed sound images. In contrast, reverberation produces a wash of sound, with no discrete echoes.

ECHO BUSS
A typically dedicated audio channel within an audio mixing console, through which is routed signals intended to be sent or received to or from an echo or reverberation device such as an echo chamber.

EDDY CURRENT
Electrical currents caused in electrical conductors (metals) by the presence of magnetic field variations. These eddy currents in turn cause local magnetic fields which act counter to the fields producing them. Most electric power meters are eddy current motors which rotate in direct proportion to the amount of current (amperes) flowing through them. Loudspeakers and transformers are designed to avoid or take advantage of eddy currents to enhance performance.

EFFECTS
Effects devices can be broadly classified as anything that changes the sound of signals passing through them. In this sense, a distorted amplifier is an effects device, although effects are usually thought of as the product of one of the following:

limiter	filter	compressor
expander	equalizer	graphic EQ
noise gate	parametric EQ	tone control
VCO	VCA	envelope filter
envelope generator	echo	reverb
digital delay	digital reverb/echo	phasor
flanger	exciter	de-esser
stresser	parametric limiter	direct box
preamplifier	octave divider	vocoder
boom-box		

EFFICIENCY
Generally, efficiency is the ratio of input and output. Efficiency is usually expressed in percent, thus a loudspeaker which produces 8 acoustic watts when fed 100 electrical watts is 8% efficient, this would represent quite a high efficiency for a cone type loudspeaker. Typical hi-fi speakers and studio monitors range between 0.01 percent and 2 percent efficiency in their ability to convert electrical watts to acoustical watts. Power amplifiers give typically 50 to 98 percent efficiency, converting 60 hertz A.C. line power into audio frequency A.C. power.

EIGHTH SPACE
One eighth of a sphere. An acoustic boundary condition where the corner of a room causes low-frequency radiation from a speaker to be folded onto itself three times; once from the floor and once from each wall, producing a 9 dB increase in sound pressure over what the source would measure if hung in free space away from reflecting surfaces.

ELECTRET
A permanently electrically polarized microphone diaphragm used in place of an external high voltage supply to allow condenser microphone operation by the variable capacitor method.

ELECTROMAGNET
A magnet formed by the presence of electrical current in a coil of wire. A loudspeaker's voice coil is an electromagnet which alternately attracts and repels the permanent magnet in which it is situated, in response to the alternating electrical input from a power amplifier.

ELECTRONIC CROSSOVER
(see CROSSOVER—ACTIVE, or ELECTRONIC)

ENCODE — ENCODED
Alteration of audio signals prior to recording on tape, discs or other recording media. The alteration usually consists of pre-equalizing the incoming audio signals so that media noise is unaltered but signals on the media contain more high frequency energy, and often compressing the incoming audio signal so that less dynamic range is required of the media to store the audio signals. Decoding is normally the exact reverse of the encode functions, allowing signals to be re-expanded by a greater amount than normal expansion of the intrinsic playback noise of the recording medium.

ENVELOPE
The trend of waveforms that forms a composite waveform that may contain all the frequencies and signal components, sidebands and interactions of the signals in the envelope.

EQUALIZATION or EQ
The intentional alteration of levels of portions of the audio frequency spectrum to fit the requirements of frequency response defined by a listener. Traditionally the term equalization was used to describe the replacement (always a boost) of energy lost as a result of long telephone line runs of wire, but today the term is used to describe any change in frequency response or spectral balance done intentionally by using any device which includes circuits that can produce these changes.

EQUALIZER
An electronic circuit or device that selectively increases or decreases gain as a function of frequency. An equalizer may boost or cut only, or may do both. It may be a fixed circuit such as the equalizer in a phonograph preamp that restores the frequency response of a phono cartridge's output to flat from the record's normal non-flat output, or the equalizer may be a sophisticated self-contained device that allows user adjustment of frequency selection or continuous frequency tuning, bandwidth or Q and amount of boost or cut (parametric equalizer).

ERASE HEAD
A magnetic tape head used to remove recorded signals from tape using a high-level, high frequency bias signal that is turned on when a tape recorder's record circuits are active.

EXPANDER
An electronic device that makes loud signals louder and quiet signals quieter, thus expanding the dynamic range of the original signals.

- F -

FADER
An electronic component such as a potentiometer, or a circuit such as a voltage-controlled amplifier, that varies the amplitude of all the audio signals passing through it. Faders can be physically linked to the user's control by straight line knobs as with linear faders, rotary knobs such as those on trim and monitor controls or by means of computer and digital-to-analog converters that supply the necessary control voltage to operate the voltage-controlled amplifier circuit comprising a VCA fader.

FARAD
The farad is the capacitance of a capacitor between the plates of which there appears a difference of potential of 1 volt when it is charged by a quantity of electricity equal to 1 coulomb.

FEEDBACK
A portion of a signal which is fed into the audio signal chain or signal-carrying circuits, either in-phase or out-of-phase with the main portion of the signal, causing a reduction or increase of signal level in the system or circuits. In acoustic situations with microphones and speakers near each other, in-phase or "positive" feedback causes the familiar howling sometimes heard when too much system gain leads to recirculating sound build-up between mic and speaker. In electronic situations such as amplifiers, out-of-phase or "negative" feedback is put to use in the amplifier's circuits to reduce distortion, and lower output impedances.

FERRITE
A mixture of ceramics, iron powders or oxides, barium or strontium carbonate or other elements such as rare earths, which is cast and sintered (heated) and used as magnetic material to make permanent magnets or transformer or inductor cores. Ferrite magnets are also known as "ceramic magnets."

FET
Field Effect Transistor. A special type of transistor noted for its very high input impedance and linear operation, as compared to common bipolar transistor types which have lower input impedances and require higher bias currents to operate. Field Effect Transistors exhibit some of the operating characteristics of vacuum tubes which suits them for applications where tubes may have been favored over bipolar transistors.

FIDELITY
As with the common definition of fidelity, true to (the original), the term is used to describe the accuracy of the reproduction of audio signals by audio devices and components usually as the sound ultimately heard from the sound system by the listener.

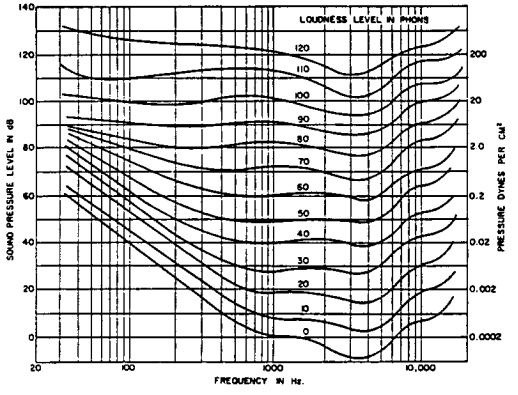
FIGURE EIGHT
The sensitivity vs. direction or angle pattern of a bipolar microphone or loudspeaker, as described on a rotating graphic level recorder chart by a pen responding to changes in level caused by the rotation of the device past a stationary sound source, or in the case of the bipolar speaker, a stationary measuring microphone.

FILTER
A circuit that selectively attenuates portions of the audio frequency spectrum. A filter is the opposite of the traditional equalizer, which selectively boosts, but for the purposes of modern convenient control of sound on mixers and equalizer units, the circuits of tone-altering controls usually incorporate the dual abilities to equalize and filter by simply rotating a knob one way or another.

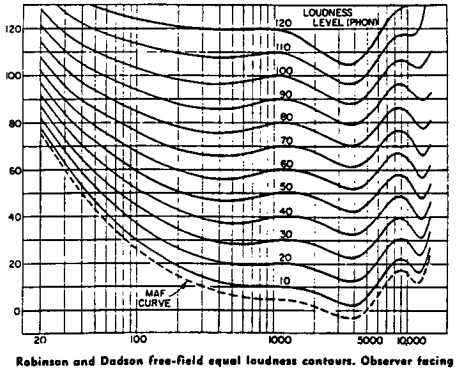
FLAT (Frequency Response)
The common term used to denote circuits, devices or audio systems that pass signals of different frequencies with equal amplitude over some range of frequencies (typically 20 hertz to 20 kHz for the audible range).

FLETCHER-MUNSON CURVES

One of several published sets of curves that graphically show how our ears perceive equal loudness for changes in frequency and for changes in sound level. Our ears are not flat and do not hear in a linear manner. At the normal threshold of hearing for humans (0 dB SPL or Sound Pressure Level), it takes some 10,000 times more acoustic power to enable us to hear a 20 hertz pure tone than it does to hear a 4000 hertz tone, while at 90 dB SPL, it requires only about twelve times more power to achieve the same relative perception of volume.



Fletcher-Munson curves (USA). (Courtesy, Acoustical Society of America)



Robinson and Dadson free-field equal loudness contours. Observer facing the source of sound.

FLOATING

A circuit which passes signals without reference to a ground. Typically, a floating audio circuit is characterized by a three-wire configuration called a "balanced line" where two wires carry the audio information and one wire acts as an electrostatic shield. The two shielded conductors of such a cable both carry equal voltage potentials of opposite polarity, from their driving source to their driven input, and so share a balanced voltage with respect to a neutral or imaginary reference. Electromagnetic radiation striking both signal carrying conductors at once is canceled by the input of the device being fed by virtue of the fact that the input circuit responds only to the differential voltage of the two signal carrying conductors, and the electromagnetic interference appears equally on both conductors, producing no differential voltage at the input. The reference wire or shield, may or may not be grounded, depending on ground loop currents that may be amplified causing hum in the system. Often, grounding is accomplished by mechanical connection of audio component chassis within a metal rack enclosure, in which case shielded wiring is unnecessary for balanced inputs and outputs.

Early telephone technology used transformer balanced inputs where a center tap of the transformer winding was grounded to dump electrostatic potentials. This type of wiring used an actual ground connection as the zero-voltage reference against which the two signal carrying conductors were balanced, thus enabling use of simple twisted pair, unshielded conductors for transmission of signals over long land lines where shielded cable would have proved prohibitively expensive but immunity to radio interference was required.

FLUTTER

Output amplitude variations from an audio reproducer such as a tape or record player due to one of several types of mechanically-based problems. Flutter may consist of simple amplitude modulations (AM) in output caused by rough tape handling or out-of-round idlers, or may take the form of frequency modulation (FM), small pitch variations, from bent or unevenly machined capstans or drive motors, pulleys or belts. AM components of flutter may also include tape modulation noise caused by uneven magnetic coatings or amplitude variations caused by loose magnetic oxide particles preventing good tape-to-head contact. FM components of flutter may also include scrape noise from tape-to-head, tape-to-tape guide or tape to flutter idler contact. Flutter is usually thought of as rapid variations of 10 hertz or more, and in fact, FM flutter components often extend up into the upper frequencies of the audio range. Very low frequency phenomena of a similar nature are called "wow," and are characterized by the 0.56 hertz pitch variations of 33-1/3 revolution/minute records with off-center spindle holes.

FOLDBACK

(see CUE)

FOLDED HORN
A horn whose internal path length is folded to produce a more compact package.

FREQUENCY
The spacing in time, of events. In audio signals, frequency refers to the cyclic repeat of vibrations. In wire, the vibrations are electrical variations. In air, the vibrations are changes in air pressure. The ear hears air pressure variations with frequencies between about 12 times per second and 20,000 times per second or 12 Hz (hertz) and 20 kHz (kilohertz).

FREQUENCY DIVIDING NETWORK
(see CROSSOVER)

FREQUENCY RESPONSE
A measurement of how a device being measured responds to test signals of constant amplitude without regard to frequency, over a particular measurement range of frequencies. An electrical device whose specifications say it is "flat from 20 Hz to 20 kHz," will not cause any amplitude deviation in signals fed through it over that frequency range, as a result of changing the frequency of the test signal.

FULL SPACE
A sphere. An acoustic condition where there are no boundaries to reflect sound. A sound source hung in free space away from reflecting surfaces does not exhibit the same bass boost as it would if set on the floor or against a wall. (see HALF SPACE and QUARTER SPACE)

FUNDAMENTAL
Any pure tone. The pitch remaining when all harmonics (overtones) are removed from a basic frequency or musical tone, producing a pure tone. An amplifier or audio circuit that can pass a pure tone without adding any harmonics of its own is said to have low harmonic distortion.
Musical instruments usually produce tones rich in harmonics, giving each its particular sound or "timbre." Small loudspeakers will be heard to reproduce bass instruments even while producing little or no fundamental pitch because the ear and brain reconstruct the sound of the instrument based on prior knowledge of its timbre.

- G -

GAIN
An increase. Amplifiers produce gain by increasing voltage and/or current. Horns produce acoustical gain by concentrating the sound of loudspeakers to narrower angles and frequency ranges. Gain is specified in decibels (dB), and while an amplifier may be used to produce unity gain, or a net increase of 0 dB in voltage, it may produce some current gain.

GAUSS
The obsolete term denoting a magnetic flux density of 0.0001 tesla. The SI unit, tesla (T) is equal to one weber per square meter. The weber (Wb) is the unit of magnetic flux which, linking a circuit of one turn, produces in it an electromotive force of one volt as it is reduced to zero at a uniform rate in one second.

GROUND
In electronic equipment, ground is the zero voltage reference point in the circuitry. Ground is referred to as earth because true ground on power lines is provided by a heavy electrical conductor such as a copper bar, driven into the earth to make an electrical return path. This is why you become "connected" to ground when standing in water and are subject to shock from electrical equipment that is not also properly grounded.

GROUND LOOP
An electrical circuit where two or more paths to ground (true 0 volts) have different voltages as a result of current flow through wiring or chassis elements. The minute voltages on some ground legs may find their way into equipment input circuits and be amplified, causing hum, buzzing or in the worst case, inaudible high frequency oscillations, sometimes at high power levels, that can ultimately cause destruction of tweeter voice coils or even burn out amplifiers.

Ground loops are eliminated by tracing the small unwanted voltages with an oscilloscope to find and isolate their sources from other circuitry. Often, shields must be disconnected or chassis modified to prevent poor packaging designs from causing ground current flow. Sometimes, modifying internal wiring is the only thing that will eliminate a ground loop.

- H -

HAAS EFFECT
The effect of single strong echoes masking the real direction of sound sources. First described by Helmut Haas, the effect bears on our ability to discern sound source direction and understand speech consonants, in particular, when loudspeakers used for sound reinforcement produce sound arrivals before the original source (talker) or when these arrivals are too loud with respect to the original source.

HALF SPACE
One half of a sphere. An acoustic boundary condition where a surface causes low-frequency radiation from a speaker to be folded onto itself (the same acoustic power filling only half the amount of space), producing a 3 dB increase in sound pressure over what the source would measure if hung in free space away from reflecting surfaces.

HARMONIC DISTORTION
Distortion which is harmonically related to the fundamental signal fed through and audio circuit or system. Harmonic distortion is characterized by a harsh sound that ranges from a slight edge on some of the high-frequency components of a musical program, to the fuzz associated with electric guitar effects pedals.

HEADROOM
The reserve voltage or power level in an audio device or system. The difference in levels between the normal or "nominal" operating levels and the peak clean (undistorted) available levels. (see also NOMINAL OPERATING LEVEL)

HENRY
The henry is the inductance of a closed circuit in which an electromotive force of 1 volt is produced when the electric current in the circuit varies uniformly at a rate of 1 ampere per second.

HERTZ
The term hertz, abbreviated **Hz**, replaces the formerly used "cycles per second" or "cps." Named after Heinrich Hertz, the term applies to any regular, cyclic vibration or event. The term hertz always involves time (seconds) no matter what the period between repetitions of the event of interest; for example, a tone vibrating 1,000 times every second is said to be at a frequency of 1,000 hertz or 1 kilohertz (kHz). The earth spinning once around every day (86,400 seconds) rotates at a frequency of 11.6 microhertz (μHz).

HIGH CUT
(see LOW PASS)

HIGH PASS
A circuit or filter that stops low frequencies and passes high frequencies. A typical high pass filter use is protection of tweeters and compression drivers from the effects of over-excursion of their moving diaphragms. Low pass filters are used to attenuate or eliminate high frequencies from the drive to woofers so that they can operate in the frequency range where they are most linear (see LOW PASS).

HISS
The unwanted random noise associated with audio tape, unmodulated record grooves and noisy amplifiers and other audio circuitry. In circuitry, hiss is caused by the thermal activity of the molecules in the materials that electronic component parts are made of.

HYSTERESIS
The lag of effect or reaction after a stimulus as in the tendency of a magnet to resist being demagnetized or of a piece of iron to become magnetized after a magnetic field from a coil is introduced into it. Hysteresis in magnetic materials provides a means of measuring how well the material will function to provide a particular magnetic field in products such as loudspeakers. Magnetic materials such as alnico demagnetize and remagnetize easily, so care must be taken in the design of magnetic structures using alnico so that the magnetic source is protected from adverse magnetic fields like those produced by voice coils. Materials such as ferrites are innately difficult to magnetize and demagnetize, allowing more freedom in the design of magnetic structures without the same regard to adverse fields.

- I -

IEC
International Electrotechnical Commission. Also, the tape playback and record equalization standard specified by the IEC and used on many european analog tape recorders.

IEEE
Institute of Electrical and Electronic Engineers.

IHF
Institute of High Fidelity.

IM
Intermodulation Distortion. A form of distortion caused by two or more audio signal components that beat against each other to produce non-harmonically related pitches which do not sound musical because they are not part of tones or chords present in the original signal.

IMPEDANCE
The total amount of opposition to the flow of alternating currents in an electrical circuit which may comprise resistance, capacitance, inductance or reactance. Reactance is the imaginary part of impedance in the case where current and voltage are not in phase in an A.C. circuit due to the circuit's components and the frequency of the signal feeding through them. In such a case the impedance may be negative.

IMPEDANCE, load
The input impedance encountered by incoming signals from an audio circuit. The impedance presented by the load to a source or network.

IMPEDANCE, matching
The use of inputs and outputs whose impedance is equal, taking into account the effects of total circuit reactance on signals passing from output to input in order to produce minimum phase shift, optimum frequency response and optimum power transfer characteristics in the circuit. The DIN (Deutche Industrie Normen) standard adopted in West Germany, calls for all devices to have input impedances 100 times larger than the output impedances of devices driving them, specifically, 100 ohms output driving 10,000 ohms input impedance. The logic involved is that sufficiently low output or source impedances are "stiff" enough to swamp out impedance effects in subsequent circuits– to prevent the tail-wagging-the-dog symptom inherent in systems for which impedance matching is the only other solution.

IMPEDANCE, source
That output impedance which, when shunted by a resistor whose value in ohms is equal to it, loses half its original output voltage. The output impedance of most modern circuits such as solid-state amplifiers, chip or IC amplifiers and so on is nearly pure resistance because their circuitry is followed by buildout resistors to protect their solid state components thus allowing circuit design based on source resistance without regard to reactive impedance effects at the outputs of electronic devices. Power amplifiers, on the other hand, generally have very low source resistance and impedance. (see DAMPING)

INDUCTANCE
The term used to describe the electrical property of an inductor (coil or choke) in units of henrys (H), millihenrys (mH), microhenrys (µH), etc. A mechanical analogy of an inductor is an electrical spring; the inductor can store electrical energy fed into it and return it directly back into the circuit. The inductor tends to block the flow of A.C. currents depending on their frequency, and pass D.C. currents through.

INFINITE BAFFLE
A loudspeaker baffle that prevents the loudspeaker's rear radiation from entering the environment where the front radiation is being used. An infinite baffle may consist of either a wall extending out from the mounting surface of the loudspeaker such as when the loudspeaker is mounted in a hole cut in a wall, or a sealed enclosure filled with highly absorbent material such as fiberglass, for the purpose of soaking up the rear radiation.

INFRASONIC
Sound at frequencies generally considered to low to be heard (sounds in the range of 1 hertz to 15 hertz). Infrasonic sound can be felt if its power level is sufficiently high, and can cause nervousness and/or fatigue and disorientation in people exposed to it.

INPUT LEVEL
The level in units such as dB, volts or watts that a particular piece of electronic equipment receives at its input. Input levels are alternately described as nominal (the normal operating level) or maximum (the level above which distortion occurs). As an example, a piece of gear might have a meter marked " VU " and its specifications might say "nominal input: +4 dBu (1.228 volt), maximum input: +24 dBu (12.28 volts)." Feeding this piece of gear a 1.228 volt input signal should cause its meter to indicate 0 dB, and increasing the input voltage to 4 volts should make the meter indicate +10.2 dB when the unit's level controls are set to unity gain (see dB conversion table on page 7).

INSERTION LOSS
The loss in signal amplitude associated with passive electrical devices or circuit elements such as transformers, autoformers or passive high-level loudspeaker crossovers, that are inserted into the signal path of an electrical or electroacoustical system.

ISOLATION, acoustic
Refers to the attenuation of sound in adjacent acoustical spaces such as the isolation of the recording studio and control room by means of heavy double doors with air spaces and triple plate glass windows. The term is also applied to circuits in equipment such as mixers, in which isolation means the opposite of crosstalk.

- J -

JAN
Joint Army-Navy specification. Pertains to the stringent government specifications used for electronic components of specified quality or survivability or of tightly maintained quality control, and often means these parts will last longer, withstand higher temperatures, voltages, currents, etc., than their consumer counterparts.

JOULE
The joule is the work done when the point of application of 1 newton of force is displaced a distance of 1 meter in the direction of the force.

JUNCTION BOX
A box that provides cable terminations at jacks or connectors such as the XL-type microphone connections at the end of a multi-conductor microphone cable or "snake."

- K -

kHz
SI units abbreviation for kilohertz. One thousand cycles per second, or the repetition of an event, vibration or oscillation at a rate of one thousand per second. The term kHz replaces the obsoleted term kc (kilocycles).

KILO-
The standard SI prefix for thousands. The prefix kilo must always be spelled and abbreviated in lower case lettering. See SI for more information on standard units and prefixes and their use.

- L -

LCD
Liquid Crystal Display. Display composed of mobile crystals in liquid suspension, which align themselves and polarize light in response to a small electric change. The crystals are manufactured in pockets within the display which correspond to areas of dark on light background.

LEAKAGE
The unwanted pickup of stray sound from sources other than the intended source feeding a specific microphone channel.

LED
Light Emitting Diode. A solid-state diode rectifier whose atomic properties cause it to emit light when electric current is passed through it. Current LED technology allows the emission of light from infrared through green frequencies, and visible light LEDs are available in colors from deep red to green.

LEDE
Live End, Dead End. A listening room design technique used primarily in recording studio control rooms, where absorptive material is placed near the loudspeakers and reflective material is placed behind the listener.

LEVEL
The amount of power present at some point in an audio system. Specifically, the term level refers to the power magnitude in either electrical watts or acoustic watts but is often incorrectly used to denote voltage. (see also POWER and SPL)

LEVELING AMPLIFIER
An alternate term for "compressor" or "limiter."

LIMITER
An audio amplifier whose output amplification rate of change is less than its input signal amplitude rate of change. While compressors are used to reduce the dynamic range of program signal either to make everything sound louder, or to automatically control sudden large changes in signal amplitude such as in the case of recording vocalists, limiters are used to prevent dynamic transient signal peaks from exceeding a pre set amplitude. Limiters are usually required when broadcast signals are fed to telephone lines, and are useful to prevent power amplifier clipping and overdriving in large sound systems. Limiters sometimes include circuits that allow the user to adjust the time it takes to start reducing the signal amplitude (attack), to ease up on the compression (release), and also the input and output gain. (see also, COMPRESSOR)

LINEAR
When the output of a device tracks its input accurately, it is said to be linear. In the case of audio equipment, the output would be directly proportional to the input.

LINE LEVEL
The average (power) level at which signal-carrying wires operate. In audio systems, operating "levels" are usually divided into three categories.

Mic level:	-90 dBm (one picowatt) to -30 dBm (one microwatt).
Line level:	-30 dBm (one microwatt) to +30 dBm (one watt).
Speaker level:	line level or higher (audible from loudspeaker).

Typical levels that might correspond to a "0 VU" meter reading for these three categories are 2.45 millivolts (-50 dBu) for microphones, 316 millivolts (-10 dBV) or 1.23 volts (+4 dBu) for mixers, tape decks and signal processing equipment, and up to 70.7 volts (+37 dBV) for loudspeakers.

LINE OUT or LINE OUTPUT
An audio equipment output that supplies signals whose average magnitude is line level, between about 10 millivolts and 25 volts.

LINE RADIATOR
Usually, a speaker system in the form of a column of similar individual loudspeakers. Column speakers exhibit the same horizontal dispersion as a single loudspeaker element within the column, but narrower vertical dispersion due to sound wavelengths and the vertical dimension of the column. (see WAVELENGTH)

LOUDNESS
Sound volume as it is detected by the average human ear. Hearing is non-flat, and this non-flatness varies with changes in absolute SPL (Sound Pressure Level). The chart on page 14 shows curves of equal loudness for various absolute SPLs.

LOUDSPEAKER
A device for making audible sound waves, typically, an electroacoustic transducer that converts alternating current electrical oscillations fed to it, into acoustic oscillations (sound). The term "driver" is often used to denote individual loudspeakers within a speaker system, while the term "speaker" is often used to refer to the entire system comprising driver(s), enclosure and crossover.

LOW CUT
(see HIGH PASS)

LOW PASS
A circuit or filter that stops high frequencies and passes low frequencies. A typical low pass filter use is the hiss or scratch filter found on many preamplifiers or receivers to reduce static or record scratch noise, which is predominantly high frequency noise the ear is quite sensitive to. Low pass filters are used to attenuate or eliminate high frequencies from the drive to woofers so that they can operate in the frequency range where they are most linear.

- M -

MASKING
Masking is sound applied to an engineered environment to provide privacy in open office areas. The term "masking" refers to the so-called "cocktail-party effect" where certain conversations are hard to pick out because similar sounds mask them. The ear-brain can be fooled into not hearing certain sounds if other sounds at lower volume but sufficient complexity are simultaneously present. Pink noise is most often used to cause intentional masking; its spectrum is shaped or filtered and fed to loudspeakers hidden above an acoustical tile ceiling.

MICROBAR
A deprecated term for one millionth of a bar, the unit of atmospheric pressure replaced by the SI unit, the pascal (Pa). Atmospheric pressure at sea level reads 1,010,300 microbars, 101.3 kPa (kilopascals), or 101,300 pascals. In terms of sound pressure level, the pascal represents 94 decibels, and the microbar represents 74 decibels. (see PASCAL, see also SPL chart on last page)

MICROPHONE
An electroacoustic transducer which produces alternating current electrical signals proportional to sound signals to which it is exposed. Microphones are usually grouped into categories according to their directional sensitivity characteristics, their means of producing electrical signals, or the type of sound field they respond to i.e., some microphones respond to changes in air particle density (pressure microphones) and some to air particle motion (velocity microphones). Combinations of pressure, velocity or phase sensitivity can be employed in the design of microphones to yield nearly any desired pickup pattern.

MONAURAL
Having one ear. Monaural headsets (with a single earpiece) are typically used by telephone operators, stage managers and disco operators.

MONITOR
A device used as a reference for determining the integrity or quality of original program signals. Television monitors seldom have tuners or other extras, are adjusted for neutral color rendition (true color) and must have bandwidth (resolution) capabilities greater than the signals they are intended to display. Monitor speakers, like video monitors, should exhibit bandwidth that extends beyond the intended signal bandwidth, should be free of sound coloration and should have adequate resolution (accuracy) to make any faults such as ticks or hum audible to the operator. The dynamic range of both our eyes and ears, far exceed the capabilities of monitor devices to display or produce accurate facsimiles of life, so monitor use should include thoughtful adjustment of dynamics to make visual or sound images fit the capabilities of the monitor. These take the form of volume

level adjustment for monitor speakers and brightness and contrast range adjustment for video monitors.

MONOPHONIC or MONO
Sound from one source, such as a single loudspeaker or earphone.

MULTI-MICROPHONE MONO
As used in multitrack recording of popular music, single microphone mono sounds are recorded onto various tape channels and then mixed together, using pan pots to adjust the left-to-right panoramic image position of each channel to create an impression of stereo sound when the final two-channel (stereo) program product is heard through headphones or stereo speakers.

MYLAR
Registered trade name of a particular polyester plastic manufactured by E.I. DuPont DeNemours Chemicals, Inc. Some of the many uses of Mylar include backing for recording tape, winding film for electric capacitors, and professional-use drum heads.

- N -

NAB
National Association of Broadcasters.

NANO-
The internationally used (SI) unit prefix designating divide by one billion or multiply by one billionth (10^{-9} or 1/1,000,000,000). The nano prefix is always written in lower case and always abbreviated simply by the letter n. Such prefixes are written with units such as meters (nm) or watts (nW) with no space between prefix and unit, but a single space after the numerical descriptor. The terms "250 nanowebers per meter" would therefore be written, 250 nWb/m.

NANOWEBER
One billionth (10^{-9} or 0.000000001) of a weber. The weber is the SI unit of magnetic flux. (see WEBER)

NEWTON
The newton is that force which gives to a mass of 1 kilogram an acceleration of 1 meter per second per second.

NOISE
Any unstructured and generally unwanted signal. Hum, buzz, hiss, crosstalk and rumble are typically classed as noise.

Random noise, as the name suggests, is noise consisting of random frequencies with random time and amplitude characteristics.

White noise is random noise whose various frequency components all share the same energy density characteristics, producing the same voltage at any particular discrete frequency over a period of time, thus causing a frequency response trend that rises the same number of decibels as the percentage of frequency increase. The 10 dB per decade of frequency (ten times power for ten times frequency) or 3 dB per octave of frequency (doubling of power for a doubling of frequency) is indicative of how many more discrete frequencies are crammed together in the same percentage of bandwidth spacing as frequency rises.

Pink noise is filtered white noise that exhibits a constant power in any band of frequencies of the same span percentage. For example the octave between 20 and 40 hertz contains only 20 hertz, while the octave between 2000 and 4000 hertz contains 2000 hertz. These two bands exhibit the same pink noise power, while the 2000–4000 hertz band would exhibit 100 times as much power if it were simply unfiltered white noise. Pink noise is used extensively as an audio measurement signal source because of its uniform power-per-bandwidth characteristic, and it has been suggested that music source material, averaged over a long time period, is roughly equivalent to pink noise in spectral energy distribution.

NOISE FLOOR
The intrinsic noise of an electronic device or system. The noise that remains in the absence of signal.

NOISE GATE
A circuit that attenuates or shuts off audio signals that fall below a threshold, usually set by the user. Noise gates are used to eliminate background hiss in sound systems and motion picture soundtrack restoration or low-level microphone leakage in multitrack, multi-microphone recording, etc.

NOMINAL OPERATING LEVEL
The design target signal level of audio circuits. For example, a crossover may have a noise floor of -80 dBu and a maximum output voltage of +24 dBu and call for a nominal operating level of +4 dBu which means that the nominal signal level will be 84 dB higher than the noise and allow for 20 dB of headroom.

- O -

OCTAVE
A doubling or halving of frequency. The numerical interval, for example, between 440 Hz and 880 Hz or 220 Hz is an octave.

OFF AXIS
(see AXIS, see POLAR PATTERN or POLAR RESPONSE)

OHM
The ohm is the electric resistance between two points of a conductor when a constant difference of potential of 1 volt, applied between these two points, produces in this conductor a current of 1 ampere, this conductor not being the source of any electromotive force.

OHM'S LAW
Physicist Georg Simon Ohm (1789–1854) described the relationship between electric current and resistance. Ohm's law states that the steady current through certain electrical circuits is directly proportional to the applied electromotive force, or, I=E/R where I is current, E is voltage and R is resistance. Equations solving for volts amperes and watts are derived from Ohm's basic equation. When calculating these quantities for A.C. circuits, the phase angle of the currents in the circuit must also be considered.

OMNI-DIRECTIONAL
Every direction. Omni-directional loudspeakers direct sound equally at all angles. Omni-directional microphones have equal sensitivity to sound coming from any angle.

OSCILLATOR
A device that oscillates. Sound is the oscillation of air caused by a mechanical oscillation such as that from a moving piano string or drum head. An electronic oscillator is a device containing circuits designed to produce electrical oscillations that are maintained, usually at a constant amplitude, and may have other specific characteristics, that suit them for use as circuit test signals.

OSCILLOSCOPE
An electronic test instrument which produces a visible image of electrical signals such as oscillations or waveforms, on a viewing screen.

OVERLOAD
The condition in which equipment is stressed beyond its normal operating limits. For sound equipment, overload may take the form of clipping in circuits, overheating of amplifiers, burning of loudspeaker voice coils, or loss of circuit integrity or breakdown. Overload may also be thought of as system operation at levels higher than the levels at which operation is linear, the overload condition producing non-linear circuit or system behavior, such as distortion. (see DISTORTION)

- P -

PAN or PAN POT
A two-circuit volume control used to place the auditory image of a sound from a mixer channel between the left and right speakers.

PASCAL
The SI unit of pressure, abbreviated Pa and defined as a pressure of 1 newton per square meter. In terms of sound it is convenient to imagine air in a balloon where the pressure is equal on the inside surface. An air pressure oscillation of one pascal R.M.S. produces a sound pressure level of 94 decibels referred to the threshold of hearing at 20 micropascals (20 μPa), and is roughly equivalent to 2.2 watts per square meter or about 100 nanowatts (10^{-9} or 0.0000001 watt) of acoustic power on human eardrums.

PASSBAND
The range of frequencies, within the -3 dB limits at the ends of the range. The "audio passband," for example, of a loudspeaker, would be the loudspeaker's frequency range within its -3 dB lower and upper frequency limits.

PASSIVE NETWORK
(see CROSSOVER)

PASSIVE RADIATOR
The passive radiator or "drone cone" is a movable mass, suspended over an opening in a speaker enclosure where it is free to resonate. The principle of operation of the passive radiator is a simple substitute for an air mass in a duct that would otherwise be too large to fit into the enclosure.

PHASE PLUG
An acoustical transformer and filter consisting of a mechanical channel or set of channels that guide sound from the moving diaphragm of a compression loudspeaker, to the exit throat of the loudspeaker. The phase plug is designed to match the diaphragm's acoustical impedance to that of a horn, and to adjust the sound path length from various areas of the diaphragm to the exit throat to maintain uniform phase. Generally, the more nearly equal are the sound paths through the phase plug from diaphragm to throat, the better the high-frequency response of the loudspeaker.

PINK NOISE
(see NOISE)

POLAR PATTERN or POLAR RESPONSE
The magnitude of output as a function of off-axis angle for speakers, or the sensitivity as a function of off-axis angle for microphones. Typically, the device (microphone or speaker) is "normalized" on-axis, that is, the on-axis

level is regarded as the 0 db reference and all measurements made off-axis then produce negative dB numbers. A horn said to have a polar pattern of 90 degrees, therefore, is one whose output level is -6 dB referred to its on-axis level, when measured 45 degrees off-axis.

POWER
Power is the conversion of energy to work. The unit of power is the watt (W). When complex signals such as music (time and voltage varying) are measured, a value for watts is derived by the use of R.M.S. (Root Mean Square) voltage divided by the load impedance to describe the amount of energy.

POWER BANDWIDTH
The frequency range over which a power amplifier can produce at least half power (-3 dB). This important specification is the actual indication of an amplifier's true power output capability, since many amplifiers are capable of much higher power outputs if frequency extremes such as those produced by music are ignored.

POWER RESPONSE
Like frequency response, power response is a measure of a loudspeaker's output with reference to its electrical input. Power response, however, includes the total sound energy radiated into the acoustic space around the loudspeaker rather than just on-axis. Flat power response, therefore, would indicate that a loudspeaker is radiating equal energy into all angles at all frequencies.

- Q -

Q
The term "Q" refers to the width of an effect. For example, a filter's Q is a measure of the frequency of the filter divided by the number of hertz contained within the band of frequencies bounded by the -3 dB points, thus an EQ filter at 1 kHz with a Q of 2 is 500 hertz wide at the -3 dB points. The Q factor of a horn is a measure of what part of a spherical pattern the horn radiates into (the beamwidth), therefore, where an omnidirectional source has a Q of 1 and the source placed on a reflecting surface has a Q of 2, a horn whose pattern is 90 by 90 degrees (one-eighth of a sphere), would have a Q of 8.

QUARTER SPACE
One quarter of a sphere. An acoustic boundary condition where two surfaces of a room cause low-frequency radiation from a speaker to be folded onto itself twice; once from each surface, producing a 6 dB increase in sound pressure over what the source would measure if hung in free space away from reflecting surfaces.

- R -

REACTANCE
The electrical characteristic of inductors and of capacitors, opposing the flow of A.C. electricity. Reactance is measured in ohms and may be negative, producing what is called an "imaginary" part of an impedance. Loudspeakers, for example, can be highly reactive, and under certain circumstances with certain signals, can feed 50 amperes or more back into the power amplifier driving them.

REFLECTION
Like light from a mirror, sound bouncing from a wall or other surface reflects. The amount and angle of sound reflection depends on the type and size of the reflecting surface, and the frequency (wavelength) of the sound.

REFLEX ENCLOSURE
A loudspeaker enclosure which uses the resonance of its internal air volume to assist the loudspeaker's motion, reducing distortion at low frequencies and extending low-frequency bandwidth.

REFRACTION
The bending of waves. Sound waves bend when they encounter boundary edges or air of a different temperature.

REMANENCE
The magnetic flux remaining in a magnetized material after a saturating magnetic field is applied and then removed.

RESISTANCE
Resistance to the flow of electric current. (see OHM)

RESISTOR
An electrical component made to resist current flow.

RESONANCE
The natural vibration or oscillation of mechanical or electrical systems at specific frequencies that depend on qualities such as mass and springiness (mechanical systems) or capacitance and inductance (electrical systems).

REVERBERATION TIME (RT_{60})
The time it takes for all reflected sounds in a space to decay 60 dB after the exciting sound source is turned off.

- S -

SABIN
The unit of acoustical absorption, named after Wallace Sabine. The sabin is the total absorbtion of sound by a surface area of one square foot.

SENSITIVITY
For mixers and amplifiers, sensitivity refers to the amount of input required to drive the circuit to its rated output.

For loudspeakers, sensitivity refers to the sound pressure produced by a given input voltage or power.

For microphones, sensitivity refers to the amount of electrical output produced by incident sound at a given sound pressure.

SI UNITS
The SI units are used to derive units of measurement for all physical quantities and phenomena. There are seven basic SI "base units," these are:

NAME	SYMBOL	QUANTITY
ampere	A	electric current
candela	cd	luminous intensity
meter	m	length
kelvin	K	thermodynamic temperature
kilogram	kg	mass
mole	mol	amount of substance
second	s	time

The SI derived units and supplementary units are listed here with applicable derivative equations:

NAME	SYMBOL	QUANTITY	DERIVED BY:
coulomb	C	quantity of electricity	A·s
farad	F	capacitance	A·s/V
henry	H	inductance	V·s/A
hertz	Hz	frequency	s^{-}
joule	J	energy or work	N·m
lumen	lm	luminous flux	cd·sr
lux	lx	illuminance	lm/m^2
newton	N	force	$kg·m/s^2$
ohm	Ω	electric resistance	V/A
pascal	Pa	pressure	N/m^2
radian	rad	plane angle	
steradian	sr	solid angle	
tesla	T	magnetic flux density	Wb/m^2
volt	V	potential difference	W/A
watt	W	power	J/s
weber	Wb	magnetic flux	V·s

FURTHER DERIVED UNITS:

NAME	SYMBOL	QUANTITY
ampere per meter	A/m	magnetic field strength
candela per square meter	cd/m^2	luminance
joule per kelvin	J/K	entropy
joule per kilogram kelvin	J/(kg·K)	specific heat capacity
kilogram per cubic meter	kg/m^3	mass density (density)
meter per second	m/s	speed, velocity
meter per second per second	m/s^2	acceleration
square meter	m^2	area
cubic meter	m^3	volume
square meter per second	m^2/s	kinematic viscosity
newton-second per square meter	$N·s/m^2$	dynamic viscosity
1 per second	s^{-}	radioactivity
radian per second	rad/s	angular velocity
radian per second per second	rad/s^2	angular acceleration
volt per meter	V/m	electric field strength
watt per meter kelvin	W/(m·K)	thermal conductivity
watt per steradian	W/sr	radiant intensity

DEFINITIONS OF SI UNITS

The **ampere** is that constant current which, if maintained in two straight parallel conductors of infinite length, of negligible circular cross section, and placed 1 meter apart in vacuum, would produce between these conductors a force equal to $2X10^{-7}$ newton per meter of length.

The **candela** is the luminous intensity, in the perpendicular direction, of a surface of 1/600,000 square meter of a blackbody at the temperature of freezing platinum under a pressure of 101,325 newtons per square meter.

The **coulomb** is the quantity of electricity transported in 1 second by the current of 1 ampere.

The **farad** is the capacitance of a capacitor between the plates of which there appears a difference of potential of 1 volt when it is charged by a quantity of electricity equal to 1 coulomb.

The **henry** is the inductance of a closed circuit in which an electromotive force of 1 volt is produced when the electric current in the circuit varies uniformly at a rate of 1 ampere per second.

The **joule** is the work done when the point of application of 1 newton is displaced a distance of 1 meter in the direction of the force.

The **kelvin**, the unit of thermodynamic temperature, is the fraction 1/273.16 of the thermodynamic temperature of the triple point of water.

The **kilogram** is the unit of mass; it is equal to the mass of the international prototype of the kilogram. (The international prototype of the kilogram is a particular cylinder of platinum-iridium alloy which is preserved in a vault at Sevres, France, by the International Bureau of Weights and Measures.)

The **lumen** is the luminous flux emitted in a solid angle of 1 steradian by a uniform point source having an intensity of 1 candela.

The **meter** is the length equal to 1,650,763.73 wavelengths in vacuum of the radiation corresponding to the transition between the levels $2p_{10}$ and $5d_5$ of the krypton-86 atom.

The **mole** is the amount of substance of a system which contains as many elementary entities as there are carbon atoms in 12 grams of carbon 12. The elementary entities must be specified and may be atoms, molecules, ions, electrons, other particles or specified groups of such particles.

The **newton** is that force which gives to a mass of 1 kilogram an acceleration of 1 meter per second per second.

The **ohm** is the electric resistance between two points of a conductor when a constant difference of potential of 1 volt, applied between these two points, produces in this conductor a current of 1 ampere, this conductor not being the source of any electromotive force.

The **radian** is the plane angle between two radii of a circle which cut off on the circumference an arc equal in length to the radius.

The **second** is the duration of 9,192,631,770 periods of the radiation corresponding to the transition between the two hyperfine levels of the ground state of the cesium-133 atom.

The **steradian** is the solid angle which, having its vertex in the center of a sphere, cuts off an area of the surface of the sphere equal to that of a square with sides of length equal to the radius of the sphere.

The **volt** is the difference of electric potential between two points of a conducting wire carrying a constant current of 1 ampere, when the power dissipated between these points is equal to 1 watt.
The **watt** is the power which gives rise to the production of energy at the rate of 1 joule per second.

The **weber** is the magnetic flux which, linking a circuit of one turn, produces in it an electromotive force of 1 volt as it is reduced to zero at a uniform rate in 1 second.

The **liter**, although not an SI derived unit, is used extensively to denote volume. Officially, the liter (l) is 1/1000 of a cubic meter.

SI PREFIXES

The names of multiples and submultiples of any SI unit are formed by application of the prefixes:

MULTIPLIER	PREFIX	SYMBOL	TIMES 1, IS EQUAL TO:
10^{18}	exa	E	1 000 000 000 000 000 000
10^{15}	peta	P	1 000 000 000 000 000
10^{12}	tera	T	1 000 000 000 000
10^{9}	giga	G	1 000 000 000
10^{6}	mega	M	1 000 000
10^{3}	kilo	k	1 000
10^{2}	hecto	h	100
10	deka	da	10
0	--	--	1 (unity)
10^{-1}	deci	d	.1
10^{-2}	centi	c	.01
10^{-3}	milli	m	.001
10^{-6}	micro	μ	.000 001
10^{-9}	nano	n	.000 000 001
10^{-12}	pico	p	.000 000 000 001
10^{-15}	femto	f	.000 000 000 000 001
10^{-18}	atto	a	.000 000 000 000 000 001

Some examples: ten-thousand grams is written: 10 kg, 20,000 cycles per second is written: 20 kHz, 10-million hertz is written: 10 MHz, and 250 billionths of a weber per meter of magnetic flux is written: 250 nWb/m.

Always use less than 1000 units with an SI prefix; "1000 MGS" is advertising hyperbole and should be written " 1 g " only.
SI prefixes and units should be written together and then set off by a space (single space in print) from their numerators. For example; use the form "35 mm " instead of " 35mm " and " 1 kHz " instead of " 1k Hz ."

When writing use standard SI formats and be consistent. You should consult National Bureau of Standards publication 330, (1977) for details on usage.

Never combine SI prefixes directly, that is, write 10^{-10} farads as 100 pF instead of 0.1 micro-microfarads (μμF). Keep in mind that whenever you write out a unit name longhand, the rule is that the name is all lower case, but when abbreviating, the first letter is upper case if the unit is named after a person and lower case if it is not; examples: V = volt for Volta, F = farad for Faraday, T = tesla for Tesla, and so on. Letter m = meter, s = second, rad = radian, l = liter and so on. Revolutions per minute may be written only

as r/min, miles per hour may be written only as mi./hr., and inches per second may be written only as in./s and so on.

In addition to the correct upper and lower case, prefixes and combinations, there is also a conventional text spacing for SI units and abbreviations. Write 20 Hz, rather than 20Hz. Write 20 kHz, rather than 20k Hz, and so on. Always separate the numerator of a unit from its prefix and/or unit name, but do not separate the prefix and name. -dd

SUBSONIC
Below the speed of sound. (see also, INFRASONIC)

SUBWOOFER
Loudspeaker system designed to produce or reproduce only low frequency sounds, typically below 150 hertz.

SUPERSONIC
Faster than the speed of sound (approximately 344 meters or 1130 feet per second at sea level). (see ULTRASONIC)

- T -

TESLA
The SI unit of magnetic flux density, derived by webers per square meter.

THIELE or THIELE-SMALL ALIGNMENT
The use of mathematical simulation of speaker system low frequency operation by calculating the values of the electrical analogies of loudspeakers and enclosures.

TIMBRE
Characteristic sound. Timbre is formed and affected by the ratios of harmonics to their fundamental, allowing for the difference heard in the same pitch played on different instruments.

TIME DELAY SPECTROMETRY
Time Delay Spectrometry is a method of measuring audio signals by creating a measurement "time window" through which signals pass without concomitant obscuring noise.

TRANSDUCER
A device which converts one form of energy directly into to another form of energy. Loudspeakers, microphones and motors are transducers which convert motion into electricity or vice versa. Light-emitting diodes and solar cells are transducers that convert electricity to light or vice versa, etc.

TRANSFORMER
A device used to isolate or to raise or lower an A.C. voltage from its input to its output. A typical transformer may consist of two separate coils of wire wound on a magnetic steel core. When an A.C. current passes through the input coil (primary) it produces an alternating magnetic field in the core, which in turn produces current flow in the output coil (secondary). By winding a greater number of coil turns for the secondary winding, the input voltage is raised at the output; by using fewer secondary turns, the output voltage is lowered. An isolation transformer uses the same number of turns for primary and secondary, maintaining the same input voltage at the output while severing the electrical connection of the two coil windings.

TRANSIENT
A momentary amplitude peak in program source. A pop from a switch or scratched record may form signal transients. Musical transients occur as a result of such things as percussion instruments, piano and guitar. Normal musical transients my have amplitude peaks as high as 40 dB above the average program levels, requiring headroom in the circuits and equipment used to reproduce them.

TRANSIENT RESPONSE
The response of audio equipment to sudden large changes in signal amplitude, such as those produced by musical transients.

TUNED ENCLOSURE
A speaker enclosure designed to use its internal air volume to aid operation of a woofer installed in it. Reflex or bass-reflex enclosures are one form of tuned enclosures. Tuned pipe enclosures use their internal air volume as a resonating air column like an organ pipe, driven by the woofer.

TUNED PORT
The vent in a reflex enclosure which causes the air inside the enclosure to resonate at a particular frequency, obtained by adjusting the vent opening size. When ducts (tubes or tunnels) are added to vent openings, the tuned frequency is lowered, allowing the use of larger vent area openings to achieve the same tuning frequency.

TWEETER
A loudspeaker designed to reproduce high frequencies only. Tweeters are typically used at frequencies beyond the center of the audio spectrum, which, if placed on a logarithmic scale like a piano keyboard, would be about 630 Hz.

- U -

ULTRASONIC
Beyond the range of human hearing. (see SUPERSONIC)

UNBALANCED
Wiring consisting of two conductors, usually one inside the other with the outer conductor shielding the inner conductor. The outer shield is connected to ground or chassis and the inner conductor carries the signal. Virtually all hi-fi signal wiring is of the unbalanced type, as is wiring inside TV sets, audio mixers and other audio equipment. (see FLOATING)

UNITY GAIN
No gain or loss. A device with unity gain would produce the same voltage at its output as the voltage applied at its input.

- V -

VA
Volt-Ampere. Like watts, VA is used to describe the product of volts multiplied by amperes, but in circuits that exhibit reactance.

VCA
Voltage Controlled Amplifier. An amplifier whose gain can be controlled by varying an external D.C. voltage. Since this D.C. voltage is relatively simple for computers to provide, the inclusion of VCAs in mixers and mixing consoles simplifies remote control of volume levels or memorized mixing functions.

VOICE COIL
A coil of wire within a magnetic field in a loudspeaker, which produces magnetic fields in response to signals from audio power amplifiers. These fields cause the voice coil to move within the stationary magnetic field of the loudspeaker, moving the diaphragm attached to it and the air touching the diaphragm.

VOICING
The equalization of sounds produced by a system such as a piano or a loudspeaker so that the audio spectrum is produced evenly with all notes or frequencies at the same volume.

VOLUME
A popular term used to denote sound intensity level.

- W -

WATT
The watt is the power which gives rise to the production of energy at the rate of 1 joule per second. (see JOULE)

WAVELENGTH
The length of waves (from crest through trough to crest) produced by propagating sound, light or electromagnetic radiation. All radiation produces waves. Sound is the slowest propagating wave, traveling approximately 344 meters or 1130 feet per second. Thus sound waves produced by a 1000 Hz tone are about 0.344 m or 1.13 foot in length (1000 per second divided by 1000 = one cycle = one wavelength). Light and electromagnetic radiation in the vacuum of space travel at 299,792.4563 kilometers or about 186,282 miles per second. Visible light waves are on the order of 450 to 700 nanometers or 17 to 28 trillionths ($28X10^{-12}$ or 0.000000000028) of an inch in length.

WAVEFORM
The shape of the wave produced by a sound. Such shapes depend on the content of harmonics of the sound, and can be viewed on an oscilloscope fed by a microphone or other sound signal source.

WEBER
The weber is the SI unit of magnetic flux. The weber is abbreviated with upper case W, lower case b (Wb). The concept of flux can be tricky to state. The International General Conference on Weights and Measures used the following wording to define the weber: The weber is the magnetic flux which, linking a circuit of one turn, produces in it an electromotive force of 1 volt as it is reduced to zero at a uniform rate in 1 second.

WET
The addition of reverberation to audio program source material makes the sound "wet" referred to "dry" sounds with no reverberation. (see DRY)

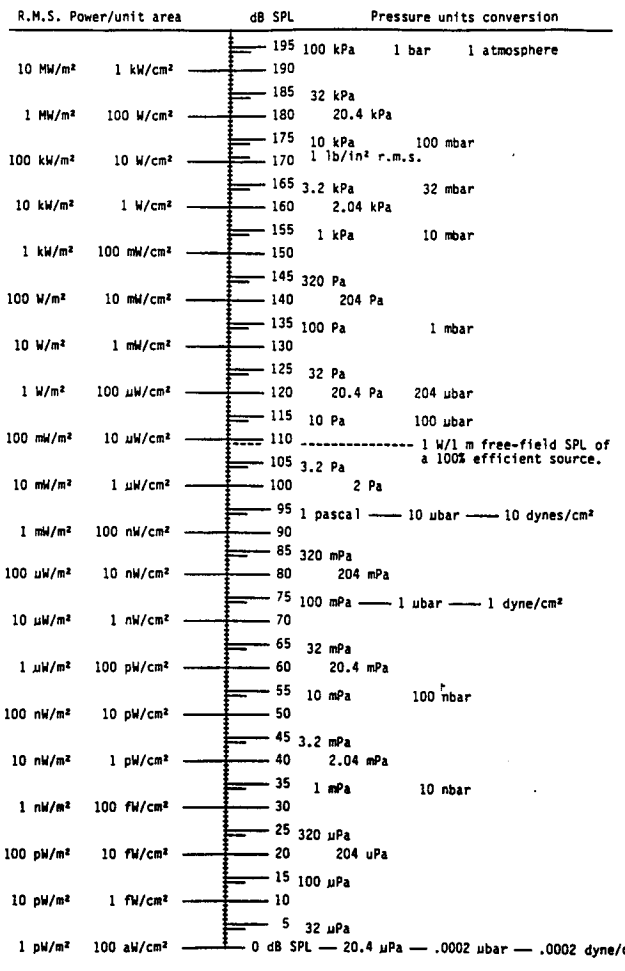
WHITE NOISE
(see NOISE)

WOOFER
A loudspeaker designed to reproduce low-frequency sound only. Some woofers are called full-range loudspeakers and are used alone e.g. ceiling speakers. Woofers in systems are usually used below about 3000 Hz.

- X -

XFMR
An abbreviation for "transformer."

XL or XLR CONNECTOR
Typically, a three-pin plug or receptacle with a metal shell, used for microphone cables and line level signal-carrying cabling.



Note: the definition of 0 dB SPL is the pressure measured at a point on the surface of a square meter which is uniformly irradiated at a power level of 10^{-12} acoustic watts. The free-field pressure reading is a sample reading taken by a pickup at a specified distance from a sound source, where both the source and pickup are of negligible size with respect to the wavelengths of sound being measured.

A "Quick Start" Application Guide to the JBL/UREI 7110 Compressor/Limiter

Introduction

This card is designed as a general information guide for the beginning user of the 7110. The settings below should be used as guidelines and not as absolute rules. With experimentation you may find "magic" settings that can take you far beyond what is outlined here. When defining the level settings we will use the following icon to indicate the relative position of each control: ⏻
The **Output** level control should be adjusted as needed to obtain the best signal to noise ratio (consult Sections 2.8 and 3 of the 7110 Owners' Manual for more information). For additional information on the 7110 see the back of this card, or, for the most complete information, consult the 7110 Owners' Manual.

General Purpose Set Up

This is a good general purpose setting that is also useful in emergency setups. Engage the **Auto** button and adjust the **Threshold** control for the desired amount of compression. The **Detector, Attack, Release,** and **Ratio** front panel controls are disengaged and a program dependent circuit is engaged.

Vocals—Lead

1. A good beginning setting is to set the following controls to the indicated positions: **Detector** ⏲ **Attack** ◐ **Release** ⏻ and the **Ratio** control anywhere from **2:1** to **4:1** compression ratio. The **Threshold** control should be set to obtain only **4 dB** to **6 dB** of gain reduction. The **Auto** button should be disengaged.
2. For a "breathier" sound on the vocals, heavier compression is necessary. Set the **Detector** ⏲ **Attack** ⏲ **Release** ◔ or ◔ and the **Ratio** control to **6:1**. The **Auto** button should be disengaged. The **Threshold** control setting will depend on the singer and program material involved, but in most cases will be at least **8 dB** and sometimes as much as **20 dB** of gain reduction.

Vocals—Problem

Vocals that are thin, sibilant, or otherwise problematic may benefit from special processing of the **Detector** signal only. This setup is shown on the reverse side of this card under the heading "How to Create a Frequency Dependent Threshold with the 7110." Equalizer frequencies and control settings may vary greatly, so some experimentation will be necessary when creating this effect.

Vocals—Background

1. If a group of vocalists is having trouble blending together, try the settings described in Pt. 1 of Vocals—Lead above, but use one compressor (or two for stereo; see Section 3.5 on linking multiple limiters in the 7110 Owners' Manual) on the whole vocal ensemble as a group, not individually. This effect can work well for basic tracks, final mixdown and live performance.

Vocals—Background (Continued)

2. For "oohs" and "aahs" or other material that should have a "breathy" type of sound, use the settings described in Pt. 2 of Vocals—Lead.
3. For a special effect and/or assistance in mixing, the 7110 may be used as a "ducker" for mixing background vocals into a busy mix. To implement this effect, feed the entire mix (or any part you desire) except the background vocals through one or two (for stereo) 7110 compressors. Next, take a send from the background vocals mix and connect it to the **Detector** input of the 7110. Engage the **Auto** button for program dependent compression, then set the **Threshold** for **2 dB** to **6 dB** of gain reduction when the background vocalists are singing. Make sure the **Link** button is engaged if you are operating in stereo (see Section 3.5 in the 7110 Owners' Manual on linking multiple limiters). Now mix the background singers in with the rest of the band. Blending should now be easier, because every time the background vocalists sing, the band's volume will be reduced from 2 dB to 6 dB. This effect may take a couple of minutes to set up, but it can make a difficult mix easier to control. This effect may also be used on lead vocals. See "How to Create a Ducking Processor" on the other side of this card for additional information.

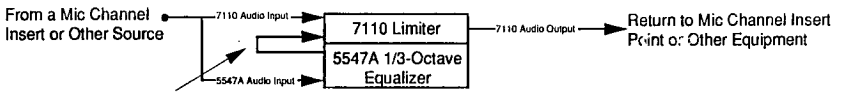
Bass Guitar

1. For a "funky" bass guitar sound, set the **Detector** ◔ **Attack** ◔ **Release** ⏻ and **Ratio** to **4:1**. The **Auto** button should be disengaged. Set the **Threshold** to achieve at least **6 dB** of gain reduction; more gain reduction may be necessary in some cases. With this setting, the bass transient of the pluck will be accentuated and the sustain and decay should be close to normal. Some fine tuning of these settings may be desirable.
2. For a longer bass guitar sustain, increase the **Ratio** setting to **6:1**, set the **Threshold** to achieve **8 dB** or more gain reduction, set the **Release** ◔ and set the **Attack** to obtain the desired amount of bass transients.

Percussion

1. Tambourines and other percussive instruments with metallic sounds may have very high transient peaks that can be controlled with the following 7110 settings: **Detector** ◔ **Attack** ◔ **Release** ◔ **Ratio** set to anywhere from **10:1** to **20:1**. The **Auto** button should be disengaged.
2. A small of amount of compression used on the kick drum may help obtain a "tight" or "punchy" kick drum sound. Set the **Detector** ◔ **Attack** ⏻ **Release** ◔ and **Ratio** from **2:1** to **4:1**, with the **Auto** button disengaged.

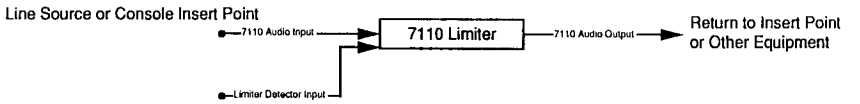
How to Create a Frequency Dependent Threshold with the 7110



5547A Output to 7110 Detector Input.

Above is a way in which the Detector input may be used to take the program signal, process it through some other device (such as an equalizer) and use that processed signal to drive the detector. One such application is known as a "de-esser." In this application the program signal is fed in parallel to the inputs of the 7110 and an equalizer which is set up to boost high frequencies above about 5 kHz. The output of the equalizer, returned through the Detector input, drives the gain reduction circuit. Because of the equalizer, the circuit has a frequency-dependent threshold which, in this case, is more sensitive to the presence of high frequency program material. Some talkers have an overabundance of high frequencies in their "esses," and this type of circuit may be used to improve the "listenability" of their speech. The Detector control should be set toward Peak, and the Attack and Release controls set to fast response.

How to Create a Ducking Processor



The above circuit allows the limiting action to be controlled by some other audio signal, instead of the signal being compressed. One example of this is known as "ducking." In this application the compressor is used to reduce the level of one signal whenever another "more important" signal is present. The example most used is that of an announcer talking over some other program material. The program material is normally passed through the compressor with little or no compression. But, whenever the announcer speaks, the compressor turns down the program material. The Threshold control, as always, sets the level for the threshold and, therefore, the amount by which the program material will be turned down. Careful adjustment of attack and release times is very important to avoid an overly processed sound. The exact adjustments will depend highly on the nature of the program material, and exactly how much "ducking" is desired. The detector control should be in the average position, since we are adjusting loudness.

In the world of creative music mixing, anything goes, and the detector input offers the capability to modify the sound in ways that are beyond the scope of this manual. Here is one example to get you started: drive the Detector input with a very low frequency sine wave signal. The audio program material can be made to rise and fall with the sine wave. Controls on the 7110 should probably be set for fast attack and release, high ratio and peak detection. This is called envelope detection.

JBL International 8500 Balboa Blvd. Northridge, California 91329 USA

Concert Series

Electronics and Complete Systems
Installation and Operating Instructions

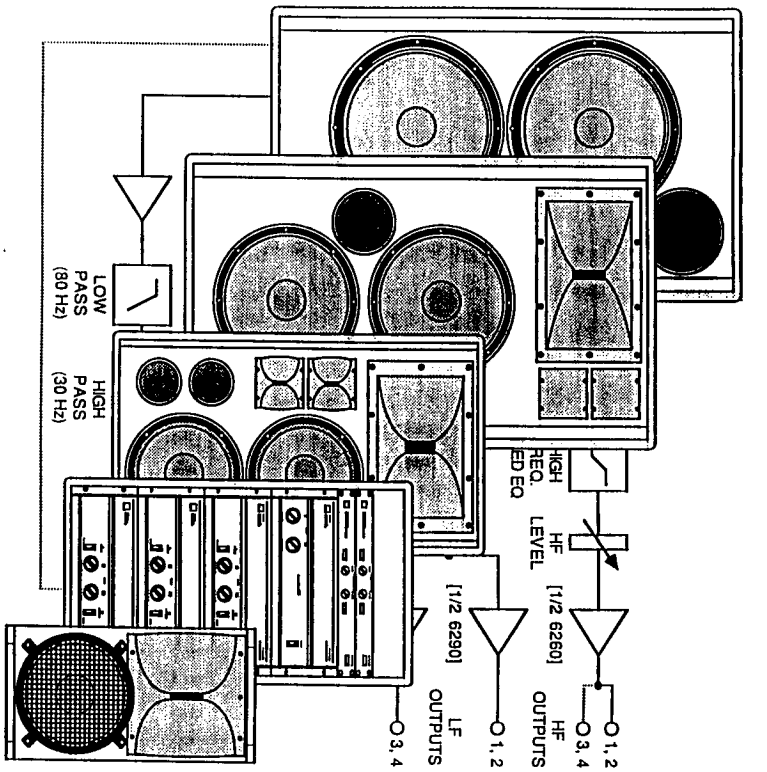


Figure 1—Concert Series Complete Systems, Components and Accessories

System Model	Standard Equipment				Optional Equipment	
	Electronics Rack	Main Loudspeakers	VLF Loudspeakers	Speaker Cables	Electronics Road Case	Speaker Dollies
4921	9922	(2) 4850 (4852)	—	(2) 3850	9916RC	(2) 4850DL
4921T	9922T	(2) 4851 (4853)	—	(2) 3850	9916RC	(2) 4850DL
4922	9922	(2) 4870 (4872)	—	(2) 3850	9916RC	(2) 4870DL
4922T	9922T	(2) 4871 (4873)	—	(2) 3850	9916RC	(2) 4870DL
4923	9923	(2) 4870 (4872)	(2) 4845	(2) 3850 (2) 3805	9916RC	(4) 4870DL
4923T	9923T	(2) 4871 (4873)	(2) 4845	(2) 3850 (2) 3805	9916RC	(4) 4870DL
4924	9923	(2) 4850 (4852)	(2) 4845	(2) 3850 (2) 3805	9916RC	(2) 4850DL (2) 4870DL
4924T	9923T	(2) 4851 (4853)	(2) 4845	(2) 3850 (2) 3805	9916RC	(2) 4850DL (2) 4870DL
4925	9922	(2) 4825	—	(2) 3850	9916RC	—
4926	9922	(4) 4825	—	(2) 3850 (2) 3805	9916RC	—
4927	9942	(8) 4825	—	(4) 3850 (4) 3805	9916RC	—
4941	9942	(4) 4850 (4852)	—	(4) 3850	9916RC	(4) 4850DL
4941T	9942T	(4) 4851 (4853)	—	(4) 3850	9916RC	(4) 4850DL
4942	9942	(4) 4870 (4872)	—	(4) 3850	9916RC	(4) 4870DL
4942T	9942T	(4) 4871 (4873)	—	(4) 3850	9916RC	(4) 4870DL
4943	9943	(4) 4870 (4872)	(4) 4845	(4) 3850 (4) 3805	9920RC	(8) 4870DL
4943T	9943T	(4) 4871 (4873)	(4) 4845	(4) 3850 (4) 3805	9920RC	(8) 4870DL
4944	9943	(4) 4850 (4852)	(2) 4842	(4) 3850 (2) 3805	9920RC	(4) 4850DL (2) 4870DL
4944T	9943T	(4) 4851 (4853)	(2) 4842	(4) 3850 (2) 3805	9920RC	(4) 4850DL (2) 4870DL
4945	9923	(2) 4825	(2) 4845	(2) 3850 (2) 3805	9916RC	(2) 4870DL
4946	9943	(4) 4825	(2) 4842	(4) 3850 (2) 3805	9920RC	(2) 4870DL

Figure 2—Concert Series Amplification Systems and Components

System Model	Type	Power Amplifiers				Signal Processing			
		VLF	LF	HF	VHF	Units	⌐	✕	⌐
9922	2-Way	—	(1) 6290	(1) 6260	—	(1) 5235	40 Hz	800 Hz	Yes (HF)
9922T	3-Way	(1) 6290			(1) 6215	(2) 5235		800 Hz, 7 kHz	
9923					—		30 Hz	80, 800 Hz	
9923T	4-Way				(1) 6215	(3) 5235		80, 800 Hz, 7 kHz	
9942	2-Way	—	(2) 6290		—	(1) 5235	40 Hz	800 Hz	
9942T	3-Way	(1) 6290			(1) 6215	(2) 5235		800 Hz, 7 kHz	
9943					—		30 Hz	80, 800 Hz	
9943T	4-Way				(1) 6215	(3) 5235		80, 800 Hz, 7 kHz	

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TABLES AND ILLUSTRATIONS

INTRODUCTION

JBL Concert Series products are designed to meet critical and demanding touring sound reinforcement and playback applications. Housed in rugged and road-worthy fiberglass-reinforced cabinetry, they will provide years of trouble-free, high-quality portable service.

The engineering design approach marries high-quality JBL/UREI electronic products with concert-proven JBL loudspeaker components for improved sound system performance, while assuring long-term reliability in touring service. Taking advantage of the 5235's flexibility and programmability, we have designed bandpass filters and fixed equalization that result in optimum performance from Concert Series loudspeaker components. Reliable system operation is assured through thoughtful loudspeaker power apportionment, and conservative component operation throughout.

This manual provides information to install and operate Concert Series products for best performance in a wide variety of applications, both portable and fixed. Specific and detailed information on component products may be found in individual component owner's manuals.

INSTALLATION

Electronics

Input Connections

Input connections to 9900 series rack equipment are via balanced XL receptacles. A parallel loop-through connector is provided for each input to enable convenient system expansion. Each input has a polarity reversal switch and a ground lift switch to adapt to a variety of drive conditions.

NOTE: The input polarity and ground lift switches are after the loop-through connector wiring and only affect the input polarity and shield connection internal to the rack.

Balanced Source Connections

Most professional mixers incorporate balanced or symmetrical outputs, which may be connected directly to 9900 racks. When source equipment is some distance from the amplifier racks, and both are properly grounded to the AC ground, the potential exists for a system ground loop. Often, several volts can be developed between different AC grounds served by a common panel. Hum, RFI and other parasitics can result when more than one path to ground is present. Good installation practice dictates that shields be connected at *one end only*, preferably at the load. Where this isn't practical, the ground lift switches may be used to isolate the source ground (shield) from the rack assembly.

Unbalanced Source Connections

The use of unbalanced sources for long cable runs is to be discouraged. Where unbalanced sources must be used, the potential for ground loops can be minimized by treating them as pseudo-balanced sources. This requires isolating the source chassis from the load chassis (except where they are connected through their respective AC grounds), and the use of two conductor shielded cable. The cable shield should be connected at the load end only, and *must not be used as a signal conductor.*

When the 9900 balanced inputs are used in this manner, no ground connection will be made between source and load. This will require the fabrication of

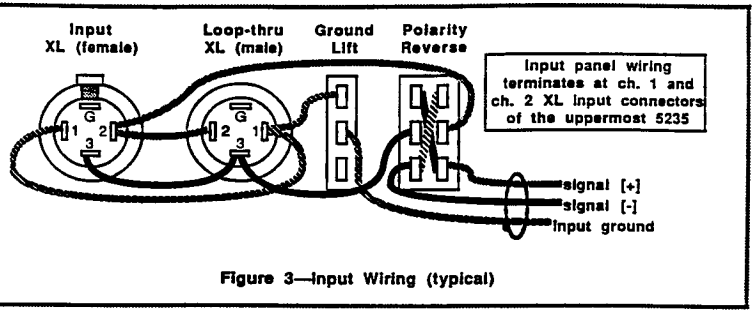
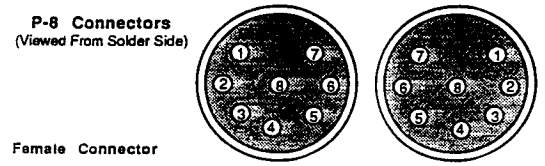


Figure 3—Input Wiring (typical)

special cables, and standard (unbalanced) pre-wired cable adapters must not be used. If these measures are unsuccessful, the output of the source may be isolated and balanced with a transformer, following the manufacturer's instructions. Under no circumstances should an AC "chester" adapter be used, as this removes the path to ground for fault currents which could occur within the instrument, resulting in a shock hazard.

Output Connections

All amplifier outputs are wired to 8-pin Cannon EP-8 receptacles, for two (stereo) channels, with either two outputs (9922/9922T, 9923/9923T), or four outputs (9942/9942T, 9943/9943T). A single 8-conductor cable assembly connects one loudspeaker to each rack output. Connections to additional loudspeakers are made via the loop-through connectors provided in the loudspeaker systems. The 8-pin output



Amplifier Output Terminals	Internal Loudspeaker Wire Colors (Where Used)	P-8 Connector Pin Wiring						
		4825/4828	4842/4845	4847	4850/4852 4870/4872	4851/4853 4871/4873	4860/4862	4861/4863
VLF+	Blue	—	1	—	—	—	—	—
VLF-	White/Blue	—	2	—	—	—	—	—
LF+	Black	3	—	3	3	3	—	—
LF-	White/Black	4	—	4	4	4	—	—
HF+	Red	5	—	—	5	5	5	5
HF-	White/Red	6	—	—	6	6	6	6
VHF+	Orange	—	—	—	—	7	—	7
VHF-	White/Orange	—	—	—	—	8	—	8

Figure 4—Output Connector Wiring

receptacles are pre-wired for four-way system operation for convenience of future expansion, with the unused cables tied off within the rack.

Figure 4 shows the EP-8 connectors, as viewed from the solder side. Note that the "+" and "-" designations in the table refer to the amplifier terminals, and not the loudspeaker terminals. For connection to other than JBL Concert Series loudspeaker systems, refer to the loudspeaker manufacturer's terminal designation data.

Connection of 4850 and 4870 systems is limited to one unit per output receptacle. This presents a 4 ohm load to the LF amplifier, which is the minimum impedance that can be safely driven.

NOTE: In 9943 and 9943T racks, output receptacles [1 and 3] and [2 and 4] are parallel-connected within the rack for VLF loudspeakers. These systems are limited to [4] model 4845 or [2] model 4842 loudspeakers, four ohms per output channel of the VLF amplifier. Because parallel connection is also possible at the loudspeaker, system owners are encouraged to adopt hook-up conventions that will prevent the inadvertent connection of four 4845s or two 4842s to one VLF amplifier output.

Absolute Polarity

All Concert Series rack assemblies and loudspeaker systems are wired so that a positive-going signal applied to pin 3 of the input receptacle(s) will result in a corresponding forward diaphragm movement at the loudspeaker(s) when the input polarity switch is in the normal position.

Loudspeakers

General

The consistent successful deployment of Concert Series systems requires that owners and installers familiarize themselves with the performance capabilities of individual loudspeaker systems, and gain a working insight into the performance gains and losses associated with multiple loudspeaker systems.

Ideally, we would be able to place as many loudspeaker systems into the same physical location as needed to deliver the required acoustic power. Since two objects cannot occupy the same space at the same point in time, we have no choice except placing our loudspeaker systems in different locations. While a detailed engineering analysis is beyond the scope and purpose of this manual, the following guidelines have been developed to assist owners and installers to gain maximum performance from Concert Series products:

Minimize Coverage Overlap

When two or more Constant Coverage systems are used, smoothest distribution results when the splay angle between cabinets yields the minumum coverage overlap. For example, if 120 degrees of horizontal distribution is desired, two 60 degree cabinets, with a 60 degree splay angle between the horizontal axes is preferred.

Group Loudspeakers Together

Where wavelengths are long compared to the size of the array (i.e. low frequencies), separate sources behave as though they were one large source, and their outputs sum coherently. Conversely, when wavelengths are short compared to the array size, interference will take place. The interference takes on a comb filter characteristic, alternating between reinforcement and cancellation as frequency increases. The larger the array is, the lower the frequency of interference onset. Place loudspeaker systems as close together as possible consistent with achieving the desired coverage.

Use Fewer Loudspeakers

Using more systems than is necessary for the application will lower the frequency of interference onset by virtue of (the larger) array size, and decrease sound system intelligibility for most of the audience. Use only the quantity of loudspeakers needed to achieve the desired coverage and SPL.

Take Advantage of the Cabinet Shape

Concert Series cabinet "footprints" describe wedge frustums: 30 degrees for the 4845 and 4870 family; 45 degrees for the 4825 and 4850 family. The shape enables moderate horizontal splay angles, while placing loudspeaker components close together. This raises the frequency of interference onset in arrays, thereby reducing overall interference.

Split Clusters

Split loudspeaker clusters are a fact of life in entertainment systems. They broaden the sound field for an audience, and lend a quality of warmth to performers on stage. They are separate sources, however, and they will interfere with one another, lending a slightly "muddy" quality to a performance by decreasing the ratio of direct-to-indirect sound energy for most of the audience. We recommend that the distance between split clusters be held to a minimum, consistent with stage width and system acoustic gain considerations.

Group VLF Systems

Whenever possible, it is advantageous to group VLF loudspeakers into a single VLF array. This will result in increased output over the entire VLF range, as the array will remain small relative to wavelengths within the bandpass.

Hanging Systems

Concert Series loudspeaker systems come equipped with aircraft-style pan fittings to facilitate rigging and hanging. Each fitting carries a rating of 900-2200 kg. (2000-5000 lbs.), depending upon pull angle, and terminates in a round head stud. Load-rated mating hardware is available in a variety of ring and stud fitting configurations from:

Stanal Sound, Ltd.
7351 Fulton Avenue
North Hollywood, CA 91605, USA
1-818+764-5200

The design of hanging systems for loudspeaker clusters is beyond the scope of this manual. Remember, that anything that is mounted overhead carries certain (and significant) liabilities to owners, installers and operators. **JBL assumes no responsibility for damages, either direct or consequential, that may result from accidents associated with the design, installation and operation of hanging loudspeaker systems.** Where hanging systems are to be fabricated, the following guidelines should be used:

1] Obtain the services of a licensed structural engineer for the design of all hanging systems, grids, and the location of appropriate hard points in the facility in which you plan to hang loudspeakers.

2] Use professional riggers for all hanging assignments. This work is dangerous and demands the services of an experienced professional.

3] Always insist upon backups to the primary rigging hardware in the event of mechanical or structural failures.

4] Always use premium-grade hardware and equipment, appropriately rated for the loads being carried. Your structural engineer will be able to advise you as to details.

5] Make certain that you have liability insurance that covers this kind of work, and that premiums are kept up to date.

For more information on hanging loudspeaker systems, contact your JBL Concert Series dealer or Stanal Sound, listed above.

Typical System Configurations

Loudspeaker system array techniques are shown in the following examples, along with performance characteristics for each example. We have selected the 4870 loudspeaker to illustrate the performance characteristics, however, the principles governing these characteristics apply to all of the Concert Series loudspeaker products. While the examples in no way exhaust the enormous range of available possibilities, they are indicative of a wide range of typical applications.

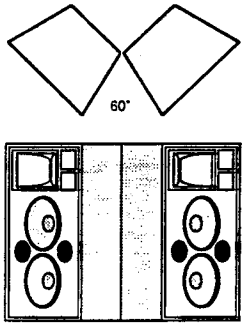


Figure 5—Two 4870 Loudspeakers Wide Coverage

Frequency Range:	**35 Hz to 20 kHz**
HF Distribution	
Horizontal:	**170 Degrees**
Vertical:	**40 Degrees**
Continuous Pgm. SPL:	**132 dB @ 1m.**
Total Amplifier Power:	**1350 watts**

In this example, the 4870 systems are splayed 90 degrees between each loudspeaker's principal axis. This requires a 60 degree angle between adjacent cabinet sides. Performance characteristics will be essentially those of individual 4870 systems, with minor high frequency response aberrations in the forward quadrant.

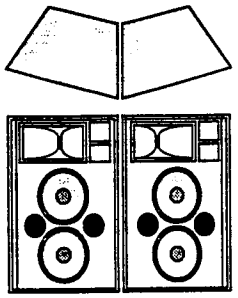


Figure 6—Two 4870 Medium Coverage

Frequency Range:	**35 Hz to 20 kHz**
HF Distribution	
Horizontal:	**120 Degrees**
Vertical:	**40 Degrees**
Continuous Pgm. SPL	**135 dB @ 1m.**
Total Amplifier Power:	**1350 watts**

In figure 6 the two loudspeaker systems are placed side-by-side, such that there is a 30 degree angle between each 4870's principal axis. This results in nominal 120 degree horizontal coverage, but with a 3 dB to 4 dB lobe in the frontal quadrant—useful in many applications.

The system configuration shown in figure 7 employs all of the 4943 components in a single array. Because the array is quite large, there will be some middle and upper frequency "fingering" of horizontal coverage. However, this will be less than would result if the enclosures were to be separated. Vertical coverage remains that of single units. Low frequency coupling will be excellent.

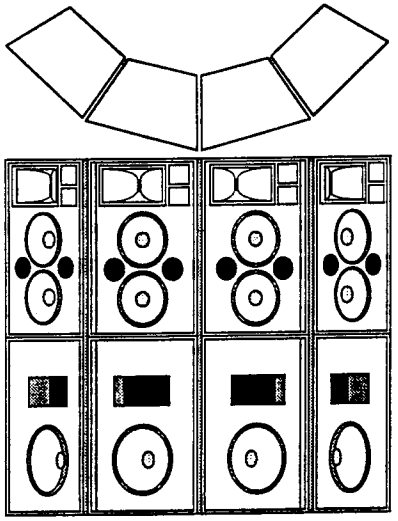


Figure 8 illustrates one technique for increasing vertical coverage. The vertical angle between cabinets can vary between 20 and 40 degrees to achieve the desired coverage. Some on-axis lobing is to be expected, along with "fingering" of coverage along the vertical axis. Horizontal coverage will remain that of single units.

Figure 7—Four 4870 Wide Coverage With VLF

Frequency Range:	**20 Hz to 20 kHz**
HF Distribution	
Horizontal:	**170 Degrees**
Vertical:	**40 Degrees**
Continuous Program SPL:	**140 dB @ 1m.**
Total Amplifier Power:	**5100 watts**

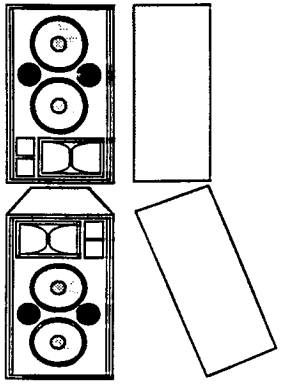


Figure 8—Two Loudspeaker Wide Vertical Coverage Array

Frequency Range	**35 Hz to 20 kHz**
HF Distribution	
Horizontal:	**90 Degrees**
Vertical:	**60-80 Degrees**
Continuous Pgm. SPL:	**135 dB @ 1m.**
Total Amplifier Power:	**1350 watts**

SETUP AND OPERATION

AC Power Connections

Systems prepared for North America operate on 120 V (nominal) AC mains, and are equipped with three-conductor supply cords and plugs.

NOTE: All 9900 series rack assemblies are wired for balanced input connections. Removing the ground pins will serve little purpose in preventing ground loops, and could present a shock hazard under certain conditions of operation. The grounding pins add mechanical integrity to receptacle connections, and should be retained for that purpose, as well as for safety reasons.

The supply of AC mains power distribution to 9900 series racks is the responsibility of the owner/installer. Figure 9 lists AC requirements for domestic and international (220/240 V) versions of 9900 series rack systems. Installers should check local regulations for circuit and conductor current limitations, and design the AC service accordingly.

	Power Consumption (watts)			Current (amps)	
System	Idle	Rated Output	-10 dB Power	120 V	220 V/ 240 V
9922	175 W	2600 W	875 W	22	11
9922T	185 W	2700 W	910 W	23	12
9923	300 W	4000 W	1350 W	33	17
9923T	310 W	4100 W	1385 W	34	18
9942	300 W	4600 W	1500 W	38	19
9942T	310 W	4700 W	1535 W	39	20
9943	425 W	6600 W	2000 W	55	23
9943T	435 W	6700 W	2035 W	56	28

Figure 9—Table of Power and Service Requirements

Three tabulations of power consumption have been listed to aid in system planning. Power consumption at idle is provided for users that don't plan on switching the system off. (Many contend that leaving the system powered up at all times greatly extends the service life of electronic components.) Consumption at rated output is calculated on the basis of rated load impedance, reflecting a worst-case (although somewhat unrealistic) usage situation. Power at -10 dB reflects a realistic demand for actual operation, and is useful for planning electric power and building heat loads. Current has been calculated for 120 V and 220/240 V operation, and indicates wiring and service requirements.

AC Connections for Portable Applications

Connecting to an unknown power source is a potential hazard to equipment and operator, and can result in total system failure (and loss of show). To prevent such a disaster, system operators are urged to obtain an electrician's circuit tester, and to verify that each and every AC receptacle to be used is of the proper voltage and correctly wired with respect to neutrals and safety grounds.

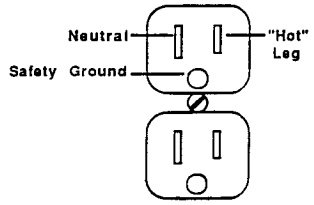


Figure 10—North American AC Receptacle Wiring

Figure 10 shows a standard duplex receptacle common to North America. The large pin on the left is the "neutral" connection, which is wired to the neutral bus at the power panel, which is grounded by means of an earth ground located nearby. The power transformer secondary center tap is also carried to earth *at the power pole*. The "safety ground" is normally strapped to the receptacle frame and physically connected to the neutral (hence ground) via mechanical conduit connections. In installations that do not use metal conduit, a separate ground wire is returned to the neutral bus in each "leg" that is fed from the power panel. The "hot" leg is wired to the power transformer secondary through circuit breakers. In the U.S.A., the white wire is "neutral", the green wire is "safety ground", and black is "hot" (although any other color except white and green may be encountered as "hot").

In earlier receptacles the vertical pins are similar in size, however, the neutral should always be on the left. Checks for AC power should include:

1] Verification that the neutral pin is the left-hand pin (receptacle oriented as above).

2] Verification that all neutrals in the system are at the same voltage potential.

3] Confirmation that the voltage between "hot" and "neutral" is 120 V (nominal).

4] Confirmation that no voltage potential exists between "neutral" and "safety ground".

5] Verification that the wiring and service breakers are of a current rating sufficient to power the system (see load table).

Powering the System Up

After verification of AC supply integrity, and before energizing AC power to rack-mounted equipment:

1] Verify that all source equipment is powered up. Many mixing consoles and signal processing devices have severe turn-on and turn-off transients, which could prove hazardous to loudspeaker components if switched on or off with the power amplifiers energized. This also holds true for microphone and pickup power supplies, should a fader channel be open.

2] Rotate all power amplifier level controls fully closed. This is further loudspeaker protection should a high-level source signal be present at the system inputs. If the mixing console is manned, be sure that the operator is aware that amplifiers are being powered up. (The operator could be adjusting compressor thresholds with 0 VU of 1 kHz at the console outputs.)

3] With the power amplifier level controls fully closed, switch the AC power on. Amplifiers should be switched on individually in large systems, rather than at the circuit breakers.

4] Slowly raise the amplifier level controls to their pre-set positions. Should a signal be present at the input, this procedure will enable its detection before damage occurs.

Powering the system down is simply a matter of switching the power amplifiers off first.

Level Setting Procedure

Because the 5235 crossovers are fitted with dedicated Concert Series processing cards, level adjustments have been made remarkably easy. The following alignment procedures call for a spectrum analyzer. Alternately, the levels can be balanced with familiar program material following the same steps.

NOTE: The recommended procedure operates all electronics with the level controls nominally full open. This improves signal-to-noise, greatly reduces the possibility of inadvertent mis-alignment, and enables rapid confirmation of level settings. In the remote possibility of a component failure, a similar device may be quickly substituted, and the system returned to its correctly balanced operation, even in the dark.

The 5235 crossovers used in the Concert Series have been equipped with HF power response correction, enabling substantially flat power response from Concert Series loudspeaker systems, but it is seldom possible to measure this on site. Atmospheric absorption of short wavelength energy at typical measurement distances can attenuate the 10 kHz region 10-12 dB below levels at 1 kHz (a perfectly natural phenomenon that generally should not be compensated for), and the directivity-frequency properties of microphones can lead to significant high frequency measurement errors. If in doubt, listen to the system using familiar program material.

NOTE: Often engineers adjust the LF and HF level controls in combination with adjustment of house EQ devices. This practice leads to inconsistent and poor system performance, and is to be discouraged. All level settings should be performed with house and program equalizers bypassed.

For permanently installed systems, it is advisable to install security covers to safeguard the amplifier level control settings. The model 6200SC security cover kit is available from JBL dealers for this purpose. Refer to the 6260 or 6290 Owner's Manual for installation instructions.

After preliminary checks for signal continuity, freedom from hum or parasitics, with the system powered up and all power amplifier level controls fully closed (counter-clockwise), rotate all 5235 level controls fully clockwise (open). Slowly open the power amplifier level controls to their full clockwise rotation.

Two-Way Systems (4922 and 4942)
Using pink noise as a program source, adjust the system level at the mixer for a comfortable output level from the Channel 1 loudspeakers. Observe the microphone output on the analyzer. The octave bands bounded by 200 Hz - 400 Hz and 1 kHz - 2 kHz should be at the same relative levels. Should a disparity be observed, the higher level can be easily and accurately attenuated at the respective power amplifier(s). Repeat this procedure for Channel 2.

Figures 11-14 show component mounting locations and output assignments. The number associated with each output assignment refers to the 8-pin output receptacle on the input/output panel, which is mounted to the rear rack rails of each respective cabinet.

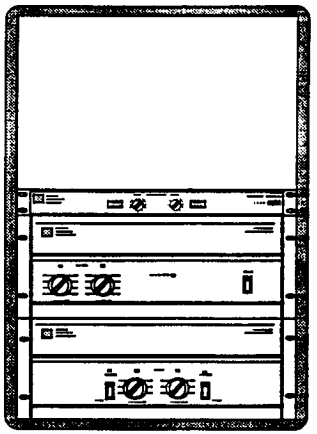


Figure 11—9922 Equipment Rack

9922 Output Assignments

6260
Channel 1—HF Output 1
Channel 2—HF Output 2.
6290
Channel 1—LF Output 1
Channel 2—LF Output 2.

The 9922 equipment rack is shown in Figure 11, along with output assignments and component designations. The 5235 is operated as a two-channel crossover system, with Channel 1 driving power amplifiers that service output connector #1, and Channel 2 driving power amplifiers connected to output connector #2.

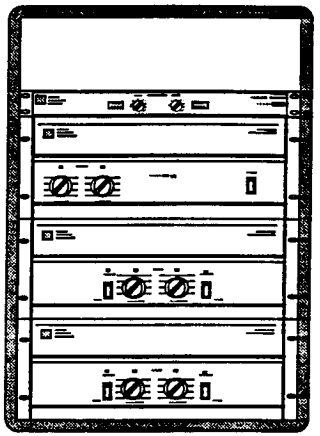


Figure 12—9942 Equipment Rack

9942 Output Assignments

6260 (Top)
Channel 1—HF Outputs 1 & 3
Channel 2—HF Outputs 2 & 4.
6290 (Middle)
Channel 1—LF Output 1
Channel 2—LF Output 2.
6290 (Bottom)
Channel 1—LF Output 3
Channel 2—LF Output 4.

Figure 12 shows the 9942 equipment rack, along with component designations and output assignments. Note that there is one LF output assignment per 6290 output channel, and two HF output assignments per 6260 output channel. The 5235 is operated as a dual-channel crossover, with Channel 1 driving power amplifiers serving odd-numbered outputs, and Channel 2 driving power amplifiers that serve even-numbered outputs.

Adding Subwoofers
Adding subwoofers to the basic two-way systems requires the 9923 or 9943 amplification and signal processing electronic racks. The uppermost 5235 in either rack handles the 800 Hz crossover and signal processing, while the lower 5235 performs the processing below 80 Hz. The LF level controls are on the bottom 5235 and the HF controls are on the top 5235. Channel one controls odd numbered outputs and channel two controls even numbered outputs. There are no VLF controls on the 5235s.

The recommended set-up procedure for three-way systems is similar to that previously described for the two-way systems, except for the addition of the VLF loudspeakers. If an analyzer is to be used in set-up, a good-quality calibrated omnidirectional condenser microphone will be required, as most dynamic microphones roll off in response above the VLF range.

Rotate all 5235 and power amplifier controls to their full open (clockwise rotation) positions. Using pink noise as a program source, adjust the level at the console for a comfortable output level from the Channel 1 loudspeakers.

WARNING: Human tolerance for high levels in the low bass region can easily result in over-driving of the VLF loudspeakers, especially on band-limited pink noise. Raise the drive level slowly, and be alert for "popping" sounds, which are indicative of undue stress on the loudspeakers or clipping of the signal. Should this occur, a reduction in level could substantially extend useful loudspeaker life.

With a reference level established on the analyzer, observe the relative levels in the 40 Hz - 80 Hz, 200 Hz - 400 Hz and 1 kHz - 2 kHz octave bands. Beginning with the octave band of highest amplitiude, adjust the respective power amplifier level control(s) to smooth the response. Use the minimum attenuation possible to equalize the amplitudes of these octaves. Repeat this procedure for channel 2 loudspeakers.

After these adjustments, it is prudent to double-check split systems with all loudspeakers operating, making any necessary level adjustments at the respective power amplifiers.

NOTE: Adjusting levels at the 5235s is not recommended in Concert Series electronics. Optimum signal-to-noise and dynamic headroom is realized in the Concert Series with all 5235 controls fully open. The power amplifier level controls are detented and calibrated to enable precise and repeatable level adjustment.

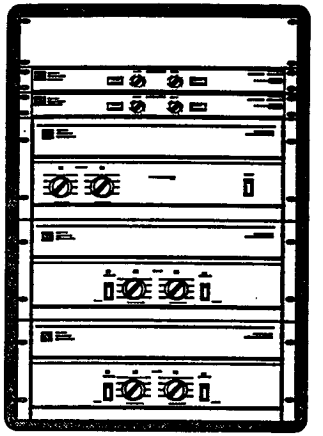


Figure 13—9923 Equipment Rack

9923 Output Assignments

6260 (Top)
Channel 1—HF Output 1
Channel 2—HF Output 2.
6290 (Middle)
Channel 1—LF Output 1
Channel 2—LF Output 2.
6290 (Bottom)
Channel 1—VLF Output 1
Channel 2—VLF Output 2.

In the 9923 system, two 5235 crossover systems are provided for three-way operation. The upper 5235 provides 800 Hz signal processing. Its high pass outputs drive the inputs of the 6260 HF amplifier and the low pass outputs drive the inputs of the bottom 5235. The lower 5235 contains 80 Hz signal processing; its high pass outputs drive the 6290 LF amplifier and the low pass outputs drive the VLF 6290. Channel one controls affect channel one outputs, likewise for channel two.

The 9943 is a two-channel three-way rack system, with output assignments as shown in Figure 14. System inputs feed the top 5235, which is equipped with 800 Hz crossover cards. The high pass outputs drive the HF amplifiers, and the low pass outputs drive the inputs of the bottom 5235. The lower 5235 high pass outputs are connected to the LF amplifiers, and the low pass outputs drive the VLF amplifier inputs. The top 5235 level controls affect odd and even numbered HF outputs, while the bottom 5235 level controls affect the odd and even LF outputs.

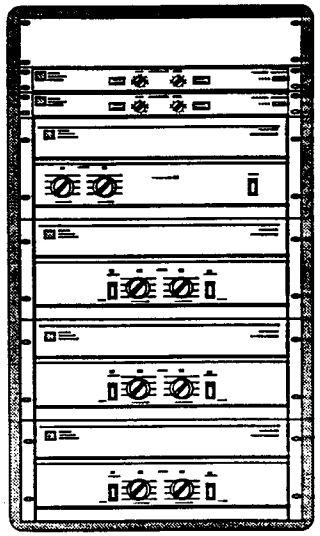


Figure 14—9943 Equipment Rack

9943 Output Assignments
6260 (Top)
Channel 1—HF Outputs 1 & 3
Channel 2—HF Outputs 2 & 4.
6290 (Second)
Channel 1—LF Output 1
Channel 2—LF Output 2.
6290 (Third)
Channel1—LF Output 3
Channel 2—LF Output 4.
6290 (Bottom)
Channel 1—VLF Outputs 1 & 3
Channel 2—VLF Outputs 2 & 4.

Systems with VHF Transducers
Three-way loudspeaker systems, models 4851, 4853, 4871 and 4873 require 9922T or 9942T electronics. When configured with subwoofer systems, the electronics systems become models 9923T or 9943T.

Adding VHF loudspeakers to existing 9922, 9942, 9923 and 9943 amplification systems requires the addition of [1] 5235 with [2] 7 kHz crossover cards (JBL part no. 52-5127) and [1] 6215 amplifier to the electronics rack. Signal flow for the 9922T/9942T is shown in figure 16. Figure 18 illustrates the signal flow for 9923T and 9943T systems.

The two-way loudspeakers, models 4850, 4852, 4870 and 4872 are equipped for the optional provision of [2] JBL Model 2404H VHF loudspeakers for increased output above 10 kHz. Installing the VHF transducers requires the removal of the grill assembly which is held in place by [4] #10-32 screws and protective washers. Remove the two blanking plates located to the right of the HF horn and release the cable ties holding the two VHF cable pairs. Bring one cable pair through each mounting hole, and connect the orange wire to the black terminal, and the white-orange wire to the red terminal of each 2404H. Mount the 2404Hs using the screws provided in the horn mounting kit.

The two 2404Hs are series-wired at the input plate for 16 ohm impedance. The VHF loudspeaker input is across terminals 7 and 8 of the loudspeaker system input connector, with *terminal 7* for connection to the amplifier's "positive" output terminal. A series capacitor with a polypropylene shunt provides DC blocking and single-pole bandpass filtering for signals one octave below the recommended crossover frequency of 7 kHz.

WARNING: Do not connect the VHF drivers to an amplifier that does not derive its input from a high pass filter having at least 12 dB/octave roll-off below 7 kHz. To do so will subject the 2404H diaphragms to excessive mechanical displacement in concert service, and probable failure.

The input panel connects to the newly added 5235, which is equipped with two 7 kHz crossover cards. The high pass outputs drive the 6215 VHF amplifier. The low pass outputs drive the second (numbered from the top of the rack) 5235, fitted with two 800 Hz crossover cards and HF response equalization. The middle 5235 high pass outputs drive the 6260 HF amplifier, while the low pass outputs feed the bottom 5235 for LF and VLF processing.

Loudspeaker Dollies
Optional loudspeaker dollies, Models 4850DL and 4870DL, are available from JBL Concert Series Dealers. The 4850DL fits Models 4850-53, while the 4870DL fits the 4842, 4845, 4847, 4860-63, 4866 and 4870-73 loudspeaker systems. To use the dollies:

1] Install the wheels to the dolly frame, using the hardware provided.

2] With the loudspeaker system upright, tilt the dolly on end in front of the loudspeaker and lift the dolly to engage the Velcro fasteners at each of the four corners of the grill assembly.

3] With the dolly firmly attached to the loudspeaker assembly by the Velcro, tilt the loudspeaker forward until the cabinet is horizontal and resting on the dolly. Pulling on the dolly will only remove it from the loudspeaker.

4] To remove the dolly from a loudspeaker, tilt the loudspeaker upright, and extract the dolly by pulling it away from the cabinet, starting at the top.

5] The dollies were designed to allow stacking of loudspeakers for transportation and storage while mounted. The underside of the dolly frames are shaped to index with the rear of the underneath cabinets, and padded with rubber to prevent sliding.

Loudspeaker Cable Assemblies
Two standard loudspeaker extension cable assemblies are available for Concert Series use. Model 3805 is a 5 foot extension, and the Model 3850 is 50 feet in length. Cables are 8-conductor 12.5 AWG wire, terminated with 8-pin Cannon™ EP-8 connectors, one each male and female.

Loudspeaker cables should be kept to the minimum length required in the interest of efficient power transfer. 12.5 AWG cable has a resistance of less than 4 ohms per 1000 feet, which will result in less than 1/2 dB loss over a 50 foot cable run with a 4 ohm loudspeaker load.

Electronics Cases
Two accessory cases are available to protect Concert Series electronic racks in portable service. Both cases are constructed from fiberglass reinforced plywood and mounted on heavy-duty casters for ease of handling. Cases part near the bottom of the rack, allowing rack assemblies to remain in the lower pod during operation. The 9916RC fits 9922, 9922T, 9923, 9923T, 9942 and 9942T racks. The 9920RC fits the 9943 and 9943T racks. Installation and operation are straightforward.

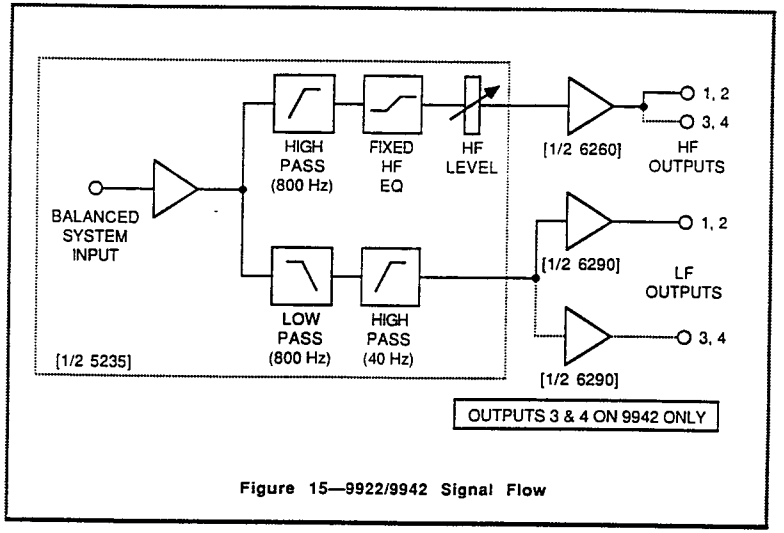


Figure 15—9922/9942 Signal Flow

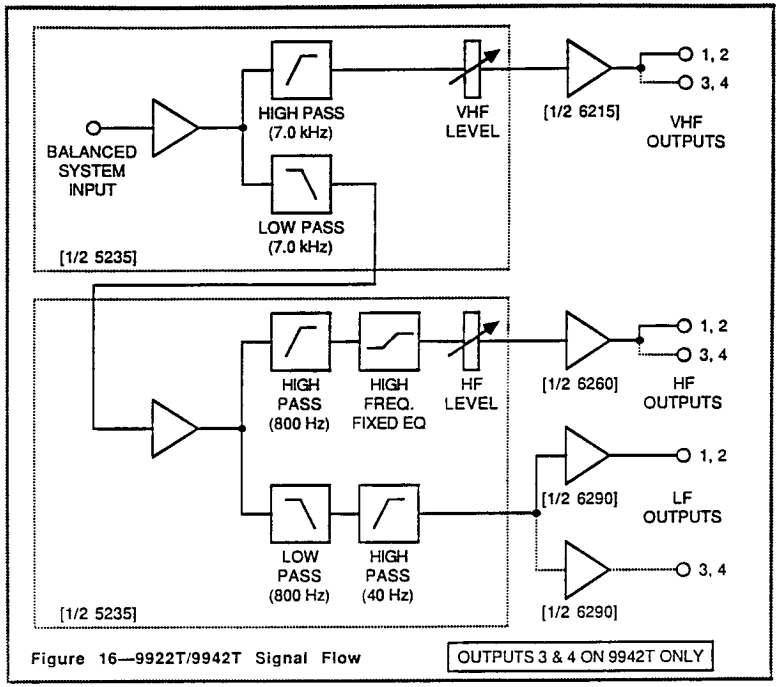


Figure 16—9922T/9942T Signal Flow

Maintenance

Concert Series electronic products are assembled from all solid-state components, ruggedly constructed with only the highest quality parts. As such, they will provide years of trouble free service with normal care. No special preventive maintenance is required, other than regular cleaning.

Loudspeaker systems should be fully tested before each performance. Touring systems in regular service should be routinely dismantled and examined for shipping and handling damage, including removal and careful inspection of compression driver diaphragms. These procedures should be done by qualified personnel, and in accordance with published methods.

Connections are the greatest source of potential difficulties in portable sound systems. Cables and connections should be carefully inspected and tested prior to sound checks for each new show installation. All internal rack wiring is labeled with the appropriate channel number, and color-coded in accordance with the following convention:

Blue: VLF
Black: LF
Red: HF
Orange: VHF

Troubleshooting

Because most Concert Series products are used for amplification of live performance, defects need to be rapidly identified and corrected. While there is no best technique for troubleshooting large systems, we encourage using systematic procedures to isolate defects.

Operators need to understand the functions of each component and their relationships with other components in the system. Carefully study the appropriate signal flow diagram in this manual, and commit it to memory. Keep a copy of this manual with the equipment at all times as a handy reference.

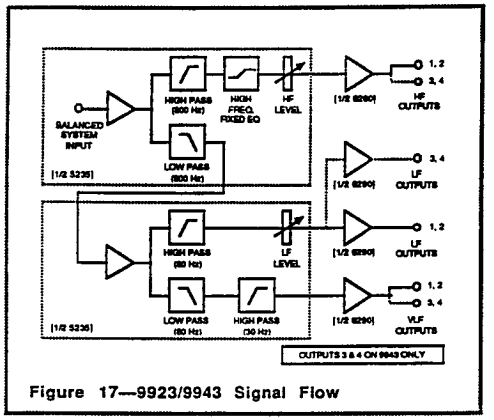


Figure 17—9923/9943 Signal Flow

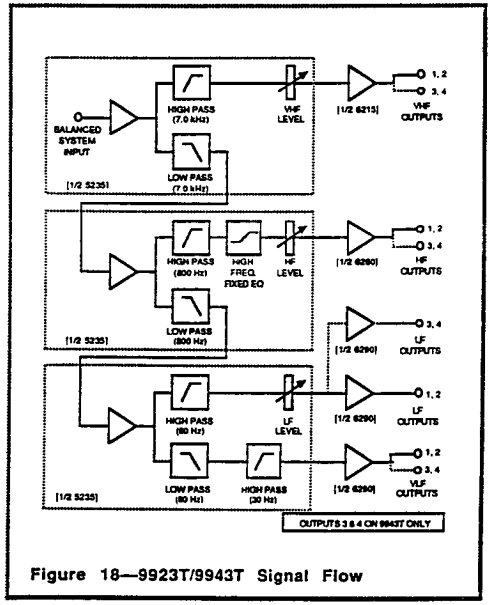


Figure 18—9923T/9943T Signal Flow

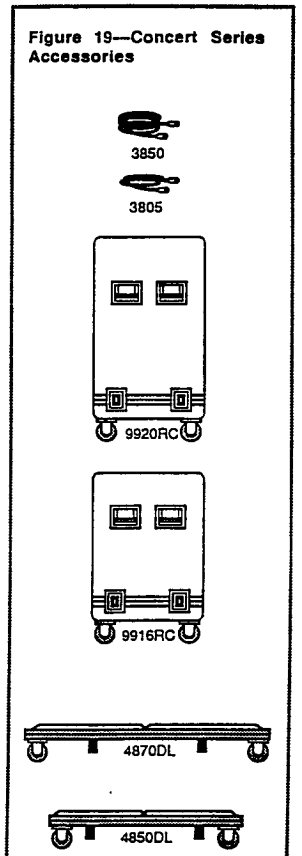


Figure 19—Concert Series Accessories

A FEW WORDS ABOUT THE JBL TRANSDUCER PARTS LIST

All JBL Professional and Consumer loudspeaker components, both current and obsolete/discontinued, are shown.

Many loudspeakers are listed with special assembly notations. To assure proper performance, please be sure to review the notes each time a loudspeaker is serviced.

Only the cone or diaphragm replacement kit that is listed for a particular model may be installed in that model for in-warranty repair purposes. Substitutions of other cones or diaphragms are considered as modifications of the product, jeopardizing future warranty coverage.

EXPLANATION OF NOTES

Our parts kit numbering system

C*R = Cone replacement

D*R = Diaphragm replacement

The number (*) between the letters is the rated impedance of the kit: 4, 8, 16 & 32. Where no number is shown, the kit is for a passive radiator.

Product Class Codes

Age	Type
1-Very old, not serviced or cannot be repaired to specs. 2-Discontinued over 5 years. 3-Discontinued within last 5 years. 4-Current product.	A-Automotive product B-Consumer and Professional products. C-Consumer/Hi-Fi product O-OEM product P-Professional product

Factory Service Only (*FSO*)

F1 - Products whose repair kits have been discontinued as a result of very low demand; these products should be returned to the JBL factory for service.

F2 - Products that do not have a repair kit available because of specialized assembly techniques which cannot be performed satisfactorily by agencies other than the factory.

F3 - Products that are not economical to repair and should be replaced instead. No repair kits are available.

PARTS LIST TABLE OF CONTENTS

ASSEMBLY NOTES

A1	Bond 2 foam pads to underside of dome.
A2	Do not use foam pads supplied with kit.
A3	If very old, may require new frame assembly to use current cone kit.
A4	Original kit discontinued, kit shown is closest substitute.
A5	This model can also be repaired with K Series kit.
A6	Repair with indicated kit only.
A7	This model is not field serviceable. Return unit to factory for repair or replacement. Units having physical damage to frame assembly will have an additional repair charge.
A8	Do not crease diaphragm.
A9	Kit shown is correct.
A10	Not serviced, parts are no longer available.
A11	Kit includes parts for similar models, use indicated parts only.
A12	Mount dome in inverted position.
A13	Use spacer gasket between compliance and frame.
C	Center Cone
F	Foam Ring
FSO	Factory Service Only
M	Moulding
MR	Mass Ring
P	Dome Pad
S	Spider
S1	Product not serialized
TR	Trim Ring
Wt	Weight of the entire component, not the cone/diaphragm assembly.

TRANSDUCER PARTS LIST

MODEL	KIT	DOME	GASKET	A-T	NOTES	
010*	*FSO* F2	-	-	3-B	S1	WT 2
011*	*FSO* F2	-	-	3-C	S1	WT 2
012*	*FSO* F2	-	-	4-B	S1	WT 2
024	D4R024	-	-	4-B	HF/SLT-1 & LT-1	WT 1
026TI	*FSO* F3	-	-	4-C	Replace, don't repair	WT 1
033	D8R033	-	-	3-C	S1	WT 3
034	D8R034	-	-	3-B		WT 2
035TI	D8R035TI	-	-	4-B		WT 2
044-1	D8R044-1	-	-	4-C	S1	WT 3
044	D8R044	-	-	3-B	S1	WT 3
044TI*	D8R044TI	-	-	4-C	Tapped mounting holes	WT 3
044TI-1*	D8R044TI	-	-	4-C	Through mounting holes	WT 3
066	D8R066	-	-	2-B	S1	WT 3
075-022	D8R075	-	-	1-0	A4	WT 6
075-105	D8R075	-	-	1-0	A4	WT 6
075-105B	D8R075	-	-	1-0	A4	WT 6
075-105C	D8R075	-	-	1-0	A4	WT 6
075-105CH	D8R075	-	-	1-0		WT 6
075-105D	D8R075	-	-	1-0	A4	WT 6
075	D8R075	-	-	3-C	A8	WT 6
075R	D8R075	-	-	2-0	A8	WT 6
076	D8R076	-	-	3-C	A8	WT 6
077	D16R2405	-	-	3-C	A8	WT 6
104H	C8R104H	51868	29931 M	4-C		WT 2
104H-2	C8R104H-2	66136	21771	4-B		WT 2
104H-3	C8R104H-2	66136	21771	4-P		WT 2
108H	C8R108	62355	52316	4-C		WT 9

TRANSDUCER PARTS LIST

MODEL	KIT	DOME	GASKET	A-T	NOTES	
112A	C8R112A	31385	21812 M	2-C		WT 11
112H	C8R112A	62183	62184 M	3-C		WT 12
115H	C8R115	62183	62184 M	4-B		WT 5
115H-1	C8R115H-1	65844	62184 M	4-C		WT 5
116A	C8R116A	50201	52316	2-B	S1, A12	WT 6
116H	C8R116A	50201	62011	3-B	S1, A12	WT 6
116H-1	C8R116H-1	62355	52316	3-B	S1, A12	WT 6
116H-2	C8R116H-2	62355	52316	4-B		WT 6
117H	C8R117	62112	62011	4-C	S1	WT 6
117H-1	C8R117	62112	62011	4-C	S1	WT 6
118H	C8R118	62112	62012	4-C		WT 6
121A	C8R121A	50201	52806	3-C	56945 MR	WT 16
121H	C8R121A	50201	52806	3-C	56945 MR	WT 22
122A	C8R129H	31385	52806	2-C	55687 MR	WT 13
122A-1	C8R129H	31385	52806	2-C	52261-0001 MR	WT 12
123A	C8R2212	31385	32756	2-C		WT 11
123A-1	C8R2212	31385	32756	2-B		WT 11
123A-2*	*FSO* F1	50201	-	2-C	A12, (C8R2212)	WT 11
123A-3	C8R2213	31385	32756	2-C		WT 11
124A	C8R2203	50201	52806	2-C	51629 MR	WT 17
124H	C8R2203	50201	52806	3-C	51629 MR	WT 24
125A	C8R127A	50201	52315	2-C	A12, S1	WT 6
126A	C8R126A	31385	52806	2-C	52261-0001 MR, A13	WT 11
127A	C8R127A	50201	52315	2-C	S1	WT 6
127H	C8R127A	50201	52315	3-C	S1	WT 6
127H-1	C8R127H-1	31385	65321	4-C	S1	WT 6
128H	C8R128H	31385	52806	3-B		WT 16
128H-1	C8R128H-1	31385	52806	4-B		WT 16

TRANSDUCER PARTS LIST

MODEL	KIT	DOME	GASKET	A-T	NOTES	
129H	C8R129H	31385	52806	3-C		WT 15
130A	C8R2220	50201	21058	2-C		WT 19
130AS	C8R2220	NOTE	21058	2-0	Requires 21060 Aluminium dome (not supplied with kit)	WT 19
130B	C16R2220	50201	21058	2-C		WT 19
130BP	C16R2220	21042	21058	2-0		WT 19
130H	C8R2220	50201	21058	2-C		WT 25
135A	C8R2235	50201	52347	2-C	51629 MR	WT 19
136A	C8R2235	50201	52347	2-C	51629 MR	WT 19
136B	C16R136B	50201	52347	2-C	51629 MR	WT 19
136H	C8R2235	50201	52347	3-C	51629 MR	WT 25
150-4	C16R1504C	50201	52347	2-P	A4 (Was 32 Ω)	WT 19
150-4C	C16R1504C	50201	52347	2-P		WT 19
150-4H	C8RE145	50201	52347	4-C		WT 19
150-H	C16R2215	50201	21058	2-P	A4 (Very old style)	WT 19
275	D16R2421	-	-	2-C		WT 12
303G	C4R303G-2	60372	-	3-C	TR59964-01, A7, S1 ,F2	WT 2
303G-1	C4R303G-2	60372	-	3-C	TR59964-01, A7, S1 ,F2	WT 2
303G-2	C4R303G-2	60372	-	3-C	TR59964-01, A7, S1 ,F2	WT 2
305G	C4R305G-1	54721	-	3-C	TR61373-01, A7, S1 ,F2	WT 2
305G-1	C4R305-G1	54721	-	3-C	TR61373-01, A7, S1 ,F2	WT 2
305G-2	C4R305G-2	54721	-	4-C		WT 2
305G-3	C4R305G-3	54721	-	4-B		WT 2
305G-4	*FSO* F3	-	-	4-C	Replace, don't repair	WT 2
306G-2	C4R306G-2	60372	-	4-B		WT 4
306G-3	C4R306G-3	-	-	4-B		WT 4
306G-4 *	*FSO* F3	-	-	4-C	Replace, don't repair	WT 4
308G	C4R308G-1	61521	-	3-C	TR61513-01, A7, S1, F2	WT 5

TRANSDUCER PARTS LIST

MODEL	KIT	DOME	GASKET	A-T	NOTES	
308G-1	C4R308G-1	61521	-	3-C	TR61513-01, A7, S1, F2	WT 5
308G-2	C4R308G-2	61521	-	4-C		WT 5
308G-3 *	*FSO* F2	-	-	4-C		WT 5
308G-4 *	*FSO* F3	-	-	4-C	Replace, don't repair	WT 5
310G	C4R310G-1	61521	-	3-C	TR61384, A7, S1, F2	WT 5
310G-1	C4R310G-1	61521	-	3-C	TR61384, A7, S1, F2	WT 5
310G-2	C4R310G-2	31521	-	4-C		WT 5
310G-3	C4R310G-3	65512	-	4-C		WT 5
312G	C4R312G-1	-	-	3-C	TR61363-01, A7, S1, F2	WT 6
312G-1	C4R312G-1	-	-	3-C	TR61363-01, A7, S1, F2	WT 6
375	D16R2440	-	-	2-C		WT 27
375AB	D16R375AB	-	-	2-0		WT 28
375EX	D16R375AB	-	-	2-0		WT 28
375FH	D16R375AB	-	-	2-0		WT 28
375H	D16R2240	-	-	2-0		WT 28
375HP	D16R375AB	-	-	2-0		WT 28
376	D16R2441	-	-	4-C	A6	WT 27
405	*FSO* F3	-	-	4-C	Replace, don't repair	
406	*FSO* F3	-	-	4-C	Replace, don't repair	
408	*FSO* F3	-	-	4-C	Replace, don't repair	
410	*FSO* F3	-	-	4-C	Replace, don't repair	
2105	C8RLE59	54721	29931 M	2-P	A6, A12	WT 2
2105H	C8RLE59	51868	29931 M	4-P	A6	WT 3
2108	C8R2108	31385	21812 M	2-P		WT 9
2108H	C8R112A	31385	21812 M	3-P	A6	WT 8
2110	C8R2110	21219	21213	2-P	A2	WT 5
2110H	C8R2110	21219	21213	3-P	A2	WT 5
2115	C16R2115	21219	21812 M	2-P	32227 P, A1	WT 9

TRANSDUCER PARTS LIST

MODEL	KIT	DOME	GASKET	A-T	NOTES	
2115A	C8R2115	21219	21812 M	2-P	32227 P, A1	WT 9
2115B	C16R2115	21219	21812 M	2-P	32227 P, A1	WT 9
2115H	C8R2115	21219	21812 M	3-P	32227 P, A1	WT 9
2115J	C16R2115	21219	21812 M	3-P	32227 P, A1	WT 9
2118H	C8R2118	62355	52316	4-P	S1	WT 8
2118J	C16R2118	62355	52316	4-P	S1	WT 8
2118J-1	C16R2118	62355	52316	4-P	S1	WT 8
2120	C8RK110	48844	21813 M	2-P		WT 10
2121	C8R2121	50201	21770	2-P	A12	WT 10
2121H	C8R2121	50201	21770	3-P	A12	WT 14
2122H	C8R2122H	31385	21770	3-P		WT 14
2123H	C8R2123H	31385	21770	4-P		WT 14
2125	C8R2125	21020	32756	2-P		WT 10
2130	C8RE120	21060	21031	2-P	A5	WT 17
2135	C8RE130	21060	21058	2-P	A5	WT 20
2145 HF	D8R2145HF	Co-ax	-	2-P	33949, A11	WT 14
2145 LF	C8R2145LF	Co-ax	32756	2-P	33949	WT 14
2145A HF	D8R2145AHF	Co-ax	-	2-P	33949	WT 14
2145A LF	C8R2145ALF	Co-ax	-	2-P	33949, A11	WT 14
2150 HF*	*FSO* F1	Co-ax	-	2-P	(C8R2150HF)	WT 23
2150 LF	C8R2150LF	Co-ax	21058	2-P	34811C	WT 23
2202A	C8R2202	21042	52806	2-P	A6	WT 17
2202B	C16R2202	21042	52806	2-P		WT 17
2202H	C8R2202	21042	52806	4-P		WT 22
2202J	C16R2202	21042	52806	4-P		WT 22
2203A	C8R2203	50201	52806	2-P	51629 R	WT 17
2203H	C8R2203	50201	52806	3-P	51629 R	WT 22
2204H	C8R2204	50201	52806	4-P		WT 24

TRANSDUCER PARTS LIST

MODEL	KIT	DOME	GASKET	A-T	NOTES	
2205A	C8R2225	50201	52347	2-P		WT 20
2205B	C16R2225	50201	52347	2-P		WT 20
2205C	C16R2225	50201	52347	2-P		WT 20
2205H	C8R2225	50201	52347	3-P		WT 25
2205J	C16R2225	50201	52347	3-P		WT 25
2212	C8R2212	31385	32756	2-B		WT 11
2213	C8R2213	31385	32756	2-B		WT 11
2213H	C8R2213	31385	32756	4-B		WT 16
2214H	C8R2214	31385	64460	4-B		WT 22
2215	C16R2215	21514	52347	2-P	Older frames may need 52880 gasket	WT 27
2215A	C8R2215	21514	52347	2-P		WT 27
2215B	C16R2215	21514	52347	2-P		WT 27
2215H	C8RLE15H	21514	52347	3-P	A6	WT 30
2216	C8RLE15B	21514	52347	2-P		WT 24
2220A	C8R2220	50201	52347	2-P		WT 20
2220B	C16R2220	50201	52347	2-P		WT 20
2220C	C16R2220	50201	52347	2-P		WT 20
2220H	C8R2220	50201	52347	4-P		WT 26
2220J	C16R2220	50201	52347	4-P		WT 26
2225H	C8R2225	50201	52347	4-P		WT 25
2225J	C16R2225	50201	52347	4-P		WT 25
2230A	C8R2235	50201	52347	2-P		WT 20
2231A	C8R2235	50201	52347	2-P	51629 MR	WT 20
2231H	C8R2235	50201	52347	3-P	51329 MR	WT 24
2234H	C8R2235	50201	52347	4-P	Do not use mass ring	WT 24
2235H	C8R2235	50201	52347	4-B	51629 MR	WT 25
2240G	C4R2240	50201	51272	4-P		WT 33
2240H	C4R2240	50201	51272	4-P		WT 33

TRANSDUCER PARTS LIST

MODEL	KIT	DOME	GASKET	A-T	NOTES	
2245H	C8R2245H	50201	51272	4-B		WT 33
2290	CR2290	50201	52347	2-P	51164 S	WT 4
2295*	*FSO* F1	-	-	2-P	(CR2295)	WT 4
2402	D8R075	-	-	3-P	A8	WT 5
2402H	D8R075	-	-	4-P		WT 6
2403	D8R076	-	-	2-P		WT 6
2403H	D8R076	-	-	3-P		WT 6
2404H	D16R2405	-	-	4-P		WT 6
2404H-1	D8R075	-	-	4-P		WT 6
2405	D16R2405	-	-	2-P	A8	WT 6
2405H	D16R2405	-	-	4-P		WT 6
2410	D16R2410	-	-	3-P	A8	WT 7
2415H	D8R2415	-	-	4-P		WT 12
2416H	D8R2416	-	-	4-P		WT 12
2420	D16R2421	-	-	2-P	A8, D8R2421 optional	WT 12
2421A	D8R2421	-	-	2-P		WT 12
2421B	D16R2421	-	-	3-P		WT 12
2425H	D8R2425	-	-	3-P		WT 12
2425J	D16R2425	-	-	3-P		WT 12
2426H	D8R2425	-	-	4-P		WT 12
2426J	D16R2425	-	-	4-P		WT 12
2427H	D8R2425	-	-	4-P		WT 12
2427J	D16R2425	-	-	4-P		WT 12
2440	D16R2440	-	-	2-P		WT 28
2441	D16R2441	-	-	4-P	A6	WT 28
2445J	D16R2445	-	-	4-P		WT 32
2460	D16R2460	-	-	2-P		WT 9
2461	D16R2470	-	-	2-P		WT 9

TRANSDUCER PARTS LIST

MODEL	KIT	DOME	GASKET	A-T	NOTES	
2470	D16R2470	-	-	4-P		WT 12
2480	D16R2482	-	-	3-P	A4	WT 28
2482	D16R2482	-	-	4-P		WT 28
2485J	D16R2482	-	-	4-P		WT 28
65408LY	*FSO* F3	-	-	4-C	Replace, don't repair	
65433-1LY	*FSO* F3	-	-	4-C	Replace, don't repair	
65434LY	*FSO* F3	-	-	4-C	Replace, don't repair	
65435LY	*FSO* F3	-	-	4-C	Replace, don't repair	
65436LY	*FSO* F3	-	-	4-C	Replace, don't repair	
65437LY	*FSO* F3	-	-	4-C	Replace, don't repair	
CONTROL 1 H.F.	C1002	-	-	4-P	High frequency transducerw/baffle	
CONTROL 1 L.F.	C1003	-	-	4-P	Low frequency transducer	
CONTROL 5 H.F.	C5002	-	-	4-P	High frequency transducer	
CONTROL 5 L.F.	C5003	-	-	4-P	Low frequency transducer	
D15S	C16RE130	21060	21058	2-0	A5	WT 19
D110F	C8RK110	48844	21770	2-P		WT 10
D110F-6	C16RK110	48844	21770	2-P		WT 10
D120	C8RE120	21060	21031	2-P	A5	WT 16
D120F	C8RE120	21060	21031	2-P	A5	WT 16
D120F-2	C4RK120	21060	21031	2-P		WT 16
D120F-6	C16RE120	21060	21031	2-P	A5	WT 16
D123	C8R2125	21020	32756	2-C		WT 11
D123-3	C8RD1233	21020	52806	2-C		WT 11
D123F	C8R2125	21020	32756	2-C	A4	WT 11
D124R *	*FSO* F1	-	-	2-0	(C8RD124R)	WT 17
D130	C8RE130	21060	21058	2-C	A6	WT 19
D130F	C8RE130	21060	21058	2-P	A5	WT 19
D130F-2	C4RE130	21060	21058	2-P	A5	WT 19

TRANSDUCER PARTS LIST

MODEL	KIT	DOME	GASKET	A-T	NOTES	
D130F-6	C16RE130	21060	21058	2-P	A5	WT 19
D130H	C8RE130	21060	21058	2-P	A6	WT 25
D131	C8RE120	21060	21031	2-C	A6	WT 16
D131F	C8RE120	21060	21031	2-P	A5	WT 16
D140F	C8RE140	21060	21058	2-P	A5	WT 19
D140F-2	C4RK140	21060	21058	2-P		WT 19
D140F-6	C16RE140	21060	21058	2-P	A5	WT 19
D140R	C8RE140	NOTE	21058	2-0	A4, Requires 50201 paper	WT 19
D175	D16R2410	-	-	2-C		WT 9
D204	C8R2110	21219	21213	2-C	A1, A4	WT 6
D208	C8R2110	21219	21213	2-C	A1	WT 6
D208H	C8R2110	21219	21213	3-C	A2	WT 4
D216	C8R2110	21219	21213	2-C	32227P, A1, A4	WT 6
D260 *	*FSO* F1	-	-	2-C	(C8RD260)	WT 6
D280	C8R2110	21219	21213	2-C	(C8RD208) Dome not supplied with kit	WT 6
E110-8	C8RK110	48844	21770	4-P		WT 14
E110-16	C16RK110	48844	21770	3-P		WT 14
E120-8	C8RE120	21060	21031	4-P	A6	WT 24
E120-16	C16RE120	21060	21031	4-P	A6	WT 24
E130-4	C4RE130	21060	21058	3-P	A6	WT 27
E130-8	C8RE130	21060	21058	4-P	A6	WT 27
E130-16	C16RE130	21060	21058	3-P	A6	WT 27
E140-8	C8RE140	21060	21058	4-P	A6	WT 26
E140-16	C16RE140	21060	21058	3-P	A6	WT 26
E145-8	C8RE145	50201	52347	4-P	A6	WT 34
E145-16	C16RE145	50201	52347	3-P	A6	WT 34
E151-8	C8RE155	50201	51272	3-P	A6 (All paper)	WT 30

TRANSDUCER PARTS LIST

MODEL	KIT	DOME	GASKET	A-T	NOTES	
E155-4	C4RE155	21060	51272	4-P		WT 33
E155-8	C8RE155	21060	51272	4-P	A6 (All metal)	WT 33
G125-8	C8RG125	31385	64914	4-P		WT16
G125A-8	C8RG125	31385	64914	4-P	Painted frame	WT16
G135-8	C8RG135	31385	63686	4-P		WT16
G135A-8	C8RG135A	31385	63686	4-P		WT16
K110	C8RK110	48844	21770	2-P		WT 10
K110-4	C4RK110	48844	21813 M	2-P		WT 10
K110-16	C16RK110	48844	21770	2-P		WT 10
K120	C8RE120	21060	21031	2-P	A5	WT 16
K120-4	C4RK120	21060	21031	2-P		WT 16
K120-16	C16RE120	21060	21031	2-P	A5	WT 16
K130	C8RE130	21060	21058	2-P	A5	WT 19
K130-4	C4RE130	21060	21058	2-P	A5	WT 19
K130-16	C16RE130	21060	21058	2-P	A5	WT 19
K140	C8RE140	21060	21058	2-P	A5	WT 19
K140-4	C4RK140	21060	21058	2-P		WT 19
K140-16	C16RE140	21060	21058	2-P	A5	WT 19
K145	C8RK145	50201	52347	2-P	A6	WT 31
K145-4	C8RK145	50201	52347	2-P	A4	WT 31
K145-16	C16RK145	50201	52347	2-P	A6	WT 31
K151	C8RK151	50201	51272	2-P	A6	WT 33
K151-4	C4RK151	50201	51272	2-P	A6	WT 33
K151-8	C8RK151	50201	51272	2-P	A4, A6	WT 33
LC14C	SEE LE14C	-	-	-		WT 22
LE5-2	C8RLE52	54721	29931 M	2-B	S1, A12	WT 4
LE5-3	C8RLE59	51868	29931 M	2-C	S1, A12	WT 4
LE5-5	C8RLE59	54721	29931 M	3-C	S1	WT 2

TRANSDUCER PARTS LIST

MODEL	KIT	DOME	GASKET	A-T	NOTES	
LE5-6	C8RLE510	51868	29931 M	3-C	S1	WT 2
LE5-8	C8RLE510	51868	29931 M	3-C	S1	WT 2
LE5-9	C8RLE59	51868	29931 M	3-B	S1	WT 2
LE5-10	C8RLE510	51868	29931 M	3-B	S1	WT 2
LE5-11	C8RLE59	51868	29931 M	3-C	S1	WT 2
LE5-12	C8RLE510	51868	29931 M	3-B	S1	WT 2
LE5H	C8RLE59	51868	29931 M	3-C	S1	WT 2
LE8	C8RLE8T	21219	21812 M	2-C	32227P, A1, A3	WT 9
LE8-1	C8RLE8T	21219	21812 M	2-C	32227P, A1, A3	WT 9
LE8-7	CRPR8	21219	21812 M	2-C	21666 S	WT 3
LE8T	C8RLE8T	21219	21812 M	2-C	A1, A3	WT 9
LE8T-2	C8R2115	21219	21812 M	2-C	A1	WT 9
LE8T-H	C8RLE8T	21219	21812 M	4-B	32227 P, A1	WT 9
LE8TX	C16R2115	21219	21812 M	2-O	32227 P, A2	WT 9
LE10	C8RLE10A	50201	21812 M	2-C	A3, A12	WT 10
LE10-101	C8RLE10A	50201	21812 M	2-C	A3, A12	WT 10
LE10A	C8RLE10A	50201	21813 M	2-C	A3, A12	WT 10
LE10A-1	C8RLE10A	50201	21813 M	2-C	A3,A12	WT 10
LE10B	C8RLE10A	50201	21813 M	2-C	A3, A4, A12	WT 10
LE10H	C8RLE111H	31385	21813 M	2-P	A6	WT 15
LE10H-1	C8RLE10H-1	31385	21813 M	4-B	3" Black paper dome	WT 15
LE12C HF	D8R2145HF	CO-AX	-	2-C	33949 S	WT 14
LE12C LF	C8R2145LF	CO-AX	32756	2-C	33949 S	WT 14
LE12C-1 HF	D8R2145HF	CO-AX	-	2-C	33949 S	WT 14
LE12C-1 LF	C8R2145ALF	CO-AX	32756	2-C	33949 S	WT 14
LE14A	C8RLE14A	50201	21811 M	2-C		WT 17
LE14A-2*	*FSO* F1	-	-	2-C	(C8RLE14A2)	WT 17
LE14C HF	D8R2145HF	CO-AX	-	2-C	A11	WT 22

TRANSDUCER PARTS LIST

MODEL	KIT	DOME	GASKET	A-T	NOTES	
LE14C LF	C8RLC14CLF	CO-AX	21811 M	2-C	21483 S	WT 22
LE14H	C8RLE14A	50201	21811 M	3-C		WT 25
LE14H-1	C8RLE14H-1	50201	20253	4-C		WT 25
LE15A	C16R2215	50201	21058	2-C	A9	WT 27
LE15B	C8RLE15B	50201	21058	2-C		WT 27
LE15H	C8RLE15H	50201	21058	4-C	A6	WT 30
LE20	D8RLE20	-	-	2-C	A11	WT 4
LE20-1	D8RLE20	-	-	2-B	21600 T	WT 2
LE21H	D8RLE25	21606	-	3-C	50402 F	WT 2
LE25	D8RLE25	21606	-	2-B	50402F, S1, A11	WT 2
LE25-1	D8RLE25	21606	-	2-B	50402F, S1, A11	WT 2
LE25-2	D8RLE252	21606	-	2-B	53363F, S1, A11	WT 2
LE25-3	D8RLE252	21606	-	2-C	53363F, S1, A11	WT 2
LE25-4	D8RLE254	21606	-	3-C	54279F, S1, A11	WT 2
LE25-5	D8RLE254	21606	-	2-C	54279F, S1, A11	WT 2
LE26	D8RLE26	21606	-	3-B	S1	WT 2
LE30	No longer available	-	-	1-C	A10	WT 6
LE75	D16R2410	-	-	2-C		WT 9
LE85	D16R2421	-	-	3-C		WT 12
LE100S	D16R2460	-	-	2-O		WT 12
LE111A	C8RLE111A	31385	21813 M	2-B		WT 12
LE111H	C8RLE111H	31385	21770	3-B	A6	WT 13
LE175	D16R2410	-	-	2-C		WT 9
LE175-200	D16R2410	-	-	2-O		WT 13
LE175DLH	D16R2410	-	-	2-C		WT 13
LE175HP	D16R2460	-	-	2-O		WT 13
LT-1	C8RLT-1	-	-	4-C		
M10	C8RK110	48844	21813 M	2-O		WT 10

TRANSDUCER PARTS LIST

MODEL	KIT	DOME	GASKET	A-T	NOTES	
M11	C8RK110	48844	21813 M	2-O		WT 10
M11-4	C4RK110	48844	21813 M	2-O		WT 10
M11-16	C16RK110	48844	21813 M	2-O		WT 10
M12-8	C8RK110	48844	21813 M	2-O		WT 10
M12-16	C16RK110	48844	21813 M	2-O		WT 10
M20	C8RE120	21060	21031	2-O	A5	WT 16
M21	C8RE120	21060	21031	2-O	A5	WT 16
M21-4	C4RK120	21060	21031	2-O		WT 16
M21-16	C16RE120	21060	21031	2-O	A5	WT 16
M22-8	C8RE120	21060	21031	2-O	A6	WT 16
M22-16	C16RE120	21060	21031	2-O	A6	WT 16
M30	C8RE130	21060	21058	2-O	A5	WT 19
M31	C8RE130	21060	21058	2-O	A5	WT 19
M31-4	C4RE130	21060	21058	2-O	A5	WT 19
M31-16	C16RE130	21060	21058	2-O	A5	WT 19
M32-4	C4RE130	21060	21058	2-O	A6	WT 19
M32-8	C8RE130	21060	21058	2-O	A6	WT 19
M32-16	C16RE130	21060	21058	2-O	A6	WT 19
M35-4	C4RE130	21060	21058	2-O		WT 19
M40	C8RE140	21060	21058	2-O	A5	WT 19
M41	C8RE140	21060	21058	2-O	A5	WT 19
M41-4	C4RK140	21060	21058	2-O		WT 19
M41-16	C16RE140	21060	21058	2-O	A5	WT 19
M42-8	C8RE140	21060	21058	2-O	A6	WT 19
M42-16	C16RE140	21060	21058	2-O	A6	WT 19
M45	C8RK145	50201	52347	2-O	A6	WT 31
M45-4	C8RK145	50201	52347	2-O	A6	WT 31
M45-16	C16RK145	50201	52347	2-O	A6	WT 31

TRANSDUCER PARTS LIST

MODEL	KIT	DOME	GASKET	A-T	NOTES	
M46-8	C8RE145	50201	52347	2-O	A6	WT 31
M46-16	C16RE145	50201	52347	2-O	A6	WT 31
M51-4	C4RK151	50201	51272	2-O	A6	WT 31
M55-8	C8RE155	21060	51272	2-O	A6 (All paper)	WT 33
MI-10	C8RMI10	62355	63683	3-P		WT 8
MI-10-1	C8RMI10	62355	63683	4-P	Unpainted frame	WT 8
MI-12	C8RMI12	62355	64914	3-P		WT 10
MI-12-1	C8RMI12-1	62355	64914	4-P	With grille	WT 10
MI-15	C8RMI15A	31385	63686	3-P		WT 12
MI-15A	C8RMI15A	31385	63686	3-P		WT 12
PR7	CRPR10	50201	21813 M	2-C		WT 6
PR8	CRPR8	21219	21812 M	2-C	21666 S	WT 6
PR10	CRPR10	50201	21813 M	2-C	A12	WT 4
PR10F*	*FSO* F1	-	-	2-P	(CRPR10F) Similar to K110	WT 6
PR12 *	*FSO* F1	-	-	2-C	(CR2295)	WT 4
PR14 *	*FSO* F1	-	-	2-C	(CRPR14) Similar to LE14A	WT 7
PR15	CR2290	50201	21058	2-C	32295 S	WT 8
PR15C	CRPR15C	50201	52347	2-C	32295 S	WT 8
PR15D	CRPR15C	50201	52347	2-C	32295 S	WT 8
PR15E	CR2290	21514	52347	2-0	32295 S, A4	WT 8
PR15F	CR2290	21514	52347	2-0	32295 S, A4	WT 8
PR15R	CR2290	21514	52347	3-0	32295 S, A4	WT 8
PR300	CRPR300	31385	52806	4-C		WT 5
PR310*	*FSO* F2	-	-	3-C	TR61384, A7, S1, F2	WT 3
PR310-1*	*FSO* F2	-	-	3-C		WT 3
PR310-2*	*FSO* F2-		-	4-C		WT 3
PR310G-3*	*FSO* F2	-	-	4-C		WT 3
Ampex 8*	*FSO* F1	-	-	2-O	C8RD260	Ampex

TRANSDUCER PARTS LIST

MODEL	KIT	DOME	GASKET	A-T	NOTES	
5A350	D16R2410	-	-	2-O		Dukane
5P350	D16R2460	-	-	2-O		Dukane
5A355	D162421	-	-	2-O		Dukane
5P355	D16R2470	-	-	2-O		Dukane
5A360	D16R2440	-	-	2-O		Dukane
5P360	D16R375AB	-	-	2-O		Dukane
5A390	C8RLE14A	21514	21811	2-O		Dukane
5A395 LF	C8RLC14CLF	Co-ax	21811	2-O	21483 S	Dukane
5A395 HF	D8R2145 HF	Co-ax	-	2-O		Dukane
5A415 LF	C8R2150LF	Co-ax	21058	2-O	34811C	Dukane
5A415 HF	*FSO* F1	Co-ax	-	2-O		Dukane
023101	C8RE130	21060	21058	2-O	A5	Fender
023101-A	C8RE130	21060	21058	2-O	A5	Fender
023101H	C8RE130	21060	21058	2-O	A6	Fender
023125A	C16RE120	21060	21031	2-O	A6	Fender
023125J	C16RE120	21060	21031	2-O	A6	Fender
043091	C16RE140	21060	21058	2-O	A5	Fender
043091-A	C8RE140	21060	21058	2-O	A5	Fender
043091H	C8RE140	21060	21058	2-O	A6	Fender
043109	C8RK110	48844	21813 M	2-O		Fender
043109-A	C8RK110	48844	21813 M	2-O		Fender
043109H	C8RK110	48844	21813 M	2-O		Fender
092577	C8RE120	21060	21031	2-O	A5	Fender
092577-A	C8RE120	21060	21031	2-O	A5	Fender
092577H	C8RE120	21060	21031	2-O	A6	Fender
970302-A	C16RE130	21060	21058	2-O	A5	Fender
970401	C8RE140	21060	21058	2-O		Fender
970401-A	C4RE140	21060	21058	2-O		Fender

TRANSDUCER PARTS LIST

MODEL	KIT	DOME	GASKET	A-T	NOTES	
970402	C16RE140	21060	21058	2-O	A5	Fender
970402-A	C16RE140	21060	21058	2-O	A5	Fender
401-132	D8RLE20	-	-	2-O	21600 T, A4	Fender
401-133	C8R2212	31385	32756	2-O	A4	Heath
401-134	C8RLE14A	50201	21811	2-O	A4	Heath
70777022	C4RE130	21060	21058	2-O		Peavey
MI11419	D16R2410	-	-	2-O		RCA
MI11426	D16R375AB	-	-	2-O		RCA
MI11426A	D16R375AB	-	-	2-O		RCA
MI11427	D16R2240	-	-	2-O		RCA

JBL Repair Kit Goes Into List

NOTES	REPAIR KIT	KIT GOES INTO/NOTES
	C8RMI10	MI-10, MI-10-1
	C8RMI12	MI-12
	C8RMI12-1	MI-12-1
	C8RMI15A	MI-15A
	CRPR8	LE8-7, PR8
	CRPR10	PR7, PR10
N/A	(CRPR10F)	*FSO*, PR10F (Similar to K110)
N/A	(CRPR14)	*FSO*, PR14
	CRPR15C	PR15C, PR15D
	CRPR300	PR300
	C8RLE52	LE5-2
D	(C8RLE55)	Replaced by C8RLE59
D	(C8RLE56)	Replaced by C8RLE510
	C8RLE59	LE5H, LE5-3!, LE5-5!, LE5-9!, 2105!, 2105H!, 2105H, LE5-11
	C8RLE510	LE5-6!, LE5-8!, LE5-10, LE5-12
	C8RLT-1	LT-1, SLT-1
	C8RLE8T	LE8, LE8-1, LE8T, LE8T-H, LE8-101
	C8RLE10A	LE10A, LE10B!, LE10, LE10-101
	C8RLE10H-1	LE10H-1
	C8RLE14A	LE14A, LE14H, 5A390, 401-134!, LE14-1
N/A	(C8RE14A2)	*FSO*, LE14A-2
	C8RLC14CLF	LC14C, LE14C, 5A395
	C8RLE14H-1	LE14H-1
	C4RA15	A15G
	C8RLE15B	LE15B, 2216
	C8RLE15H	LE15H, 2215H
D	(C16RD15S)	Replaced by C16RE130
	D8RLE20	LE20, LE20-1, 401-132!
	D4R024	024
	D8RLE25	LE21H, LE25, LE25-1
	D8RLE252	LE25-2, LE25-3
	D8RLE254	LE25-4, LE25-5

NOTES:

D - Recently discontinued, use indicated replacement.

N/A - *FSO*, Nor available, return to JBL *FACTORY SERVICE ONLY.*

! - Closest substitute available, original assemble not produced.

JBL Repair Kit Goes Into List

NOTES	REPAIR KIT	KIT GOES INTO/NOTES
	D8RLE26	LE26
	C4RA30	A30G
	D8R033	033
	D8R034	034
	D8R035TI	035TI
D	(C4M35)	M35-4, 70777022, Replaced by C4RE130
	D8R044	044
	D8R044-1	044-1
	D8R044TI	044TI, 044TI-1
	D8R066	066
	D8R075	075, 075R, 2402, 2402H, 075-022!, 075-105!, 075- 105B!, 075-105C!, 075-105CH!, 075-105D, 2404H-1
	D8R076	076, 2403, 2403H
	C8R108	108H
	C4RK110	M11-4, K110-4
	C8RK110	M10, M11, M12-8, D110F, E110-8, K110, 2120, 043109, 043109-A, 043109H
	C16RK110	M11-6, M12-6, D110F-6, E110-16, K110-16
	C8RLE111A	LE111A
	C8RLE111H	LE10H, LE111H
	C8R112A	112A, 112H, 2108H
	C8R115	115H
	C8R115H-1	115H-1
	C8R116A	116A, 116H
	C8R116H-2	116AH-2
	C8R117	117H, 117H-1
	C8R118	118H
	C8RE120	M20, M21, M22-8, D120, D120F, E120-8, K120, D131!, D131F, 2130, 092577, 092577-A, 092577H
	C16RE120	M21-16, M22-16, D120F-6, E120-16, K120-16, 023125-A, 123125J
	C4RK120	M21-4, D120F-2, K120-4
D	(C8RK120)	Replaced by C8RE120
D	(C16RK120)	Replaced by C16RE120

NOTES:

D - Recently discontinued, use indicated replacement.

N/A - "FSO", Nor available, return to JBL "FACTORY SERVICE ONLY."

! - Closest substitute available, original assemble not produced.

JBL Repair Kit Goes Into List

NOTES	REPAIR KIT	KIT GOES INTO/NOTES
	C8R121A	121A, 121H
D	(C8R122A)	Replaced by C8R129H
D	(C8R122A1)	Replaced by C8R129H
N/A	(C8R123A2)	"FSO", 123A-2
	C8RD1233	D123-3
N/A	(C8RD124R)	"FSO", D124R
D	(C8R125A)	Replaced by C8R127A
	C8RG125-8	G125-8, G125A-8
	C8R126A	126A
	C8R127A	125A, 127A, 127H
	C8R127H-1	127H-1
	C8R128H	128H
	C8R128H-1	128H-1
	C8R129H	122A!, 122A-1!, 129H
D	(C8RD130)	Replaced by C8RE130
	C4RE130	M31-4, M32-4, M35-4!, D130F-2, E130-4, K130-4, 70777022!
	C8RE130	M30, M31, M32-8, D130!, D130F, D130H!, E130-8, K130, 2135 023101, 023101-A, 023101H
	C16RE130	D15S!, M31-16, M32-16, D130F-6, E130-16, L130-16, 970302-A
D	(C4RL130)	Replaced by C4RE130
D	(C8RK130)	Replaced by C8RE130
D	(C16K130)	Replaced by C16RE130
D	(C8RD131)	Replaced by C8RE120
	C8RG135	G135-8
	C8RG135A	G135A-8
	C16R136B	136B
D	(C8RD140R)	Replace with C8R2205 AND 21514 dome
	C8RE140	M40, M41, M42-8, D140F, E140-8, K140, 043091, 043091-A, 043091H, 970401!, D140R
	C16RE140	M41-16, M42-16, D140F-6, E140-16, K140-16, 970402, 970402-A!
	C4RK140	M41-4, D140F-2, K140-4, 970401-A
D	(C8RK140)	Replaced by C8RE140

NOTES:

D - Recently discontinued, use indicated replacement.

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! - Closest substitute available, original assemble not produced.

JBL Repair Kit Goes Into List

NOTES	REPAIR KIT	KIT GOES INTO/NOTES
D	(C16RK140)	Replaced by C16RE140
	C8RE145	M46-8, E145-8, 150-4H
	C16RE145	M46-16, E145-16
D	(C4RK145)	Replaced by C8RK145 OR C16RK145
	C8RK145	M45, K145, M45-4, K145-4
	C16RK145	M45-6, K145-16
	C16R1504C	150-4!, 150-4C
	C4RK151	M51-4, K151-4
	C8RK151	K151, K151-16!
D	(C8RE151)	Replaced by C8RE155
	C8RE155	M55-8, E151-8, E155-8
N/A	(C8RD260)	*FSO*, D260, AMPEX 8
D	(C8RD280)	Replaced by C8R2110 OR C8RD208
	C4R303G-2	303G, 303G-1, 303G-2
	C4R305G-1	305G, 305G-1
	C4R305G-2	305G-2
	C4R306G-2	306G-2
	C4R308G-1	308G, 308G-1
	C4R308G-2	308G-2
	C4R310G-1	310G, 310G-1
	C4R310G-2	310G-2
	C4R312G	312G, 312G-1
	D16R375AB	375AB, 375EX, 375FH, 375HP, 5P360, MI11426, MI11426A
	C8R2108	2108
	C8R2110	D204!, D208, D208H, D216!, D280!, 2110, 2110H
	C8R2115	LE8T-2, 2115A, 2115H
	C16R2115	LE8TX, 2115, 2115B, 2115J
	C8R2118	2118H
	C16R2118	2118J, 2118J-1
	C8R2121	2121, 2121H
	C8R2122H	2122H
	C8R2123H	2123H

NOTES:

D - Recently discontinued, use indicated replacement.

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! - Closest substitute available, original assemble not produced.

JBL Repair Kit Goes Into List

NOTES	REPAIR KIT	KIT GOES INTO/NOTES
	C8R2125	D123, 2125, D123F
	C8R2145LF	LE12C, 2145
	C8R2145ALF	LE12C-1, 2145A
	D8R2145HF	LE12C, LE12C-1, LE14C, 2145, 2145A, 5A395
	C8R2150LF	2150, 5A415
N/A	(C8R2150HF)	*FSO*, 2150, 5A415
	C8R2202	2202A, 2202H
	C16R2202	2202B, 2202J
	C8R2203	124A, 124H, 2203A, 2203H
D	(C8R2205)	2205A, 2205H, Replaced by C8R2225
D	(C16R22205)	2205B, 2205J, Replaced by C16R2225
D	(C32R2205)	Replaced by C8R2225 or C16R2225
	C8R2212	123A, 123A-1, 2212, 401-133!
	C8R2213	123A-3, 2213, 2213H
	C8R2214	2214H
	C8R2215	2215A
	C16R2215	LE15A, 150-H (Very old), 2215, 2215B
D	(C8R2216)	Replaced by C8RLE15B, C8R2215
	C8R2220	130A, 130AS!, 130H, 2220A, 2220C!, 2220H
	C16R2220	130B, 130BP, 2220B, 2220C!, 2220J
D	(C32R2220)	2220C, Replaced by C8R2220 PR C16R2220
	C8R2225	2205A, 2205C!, 2205H, 2225H
	C16R2225	2205B, 2205C!, 2205J, 2225J
D	(C8R2230)	Replaced by C8R2235 (Visual change)
D	(C8R2231)	Replaced by C8R2235
D	(C8R2234)	Replaced by C8R2235 (Don't use mass ring with kit)
	C8R2235	135A!, 136A!, 136H!, 2230A!, 2231A!, 2231H!, 2234H, 2235H
	C4R2240	2240G
	C8R2240H	2240H
	C8R2245H	2245H
	CR2290	PR15, PR15E, PR15F, PR15R, 2290
N/A	(CR2295)	*FSO*, PR12, 2295

NOTES:

D - Recently discontinued, use indicated replacement.

N/A - *FSO*, Nor available, return to JBL *FACTORY SERVICE ONLY.*

! - Closest substitute available, original assemble not produced.

JBL Repair Kit Goes Into List

NOTES	REPAIR KIT	KIT GOES INTO/NOTES
	D16R2405	077, 2405, 2405H, 2404H
	D16R2410	LE75, D174, LE175, LE175-200, LE175DLH, 2410, 5A350, MI11419
	D8R2415	2415H
	D8R2416	2416H
	D16R2420)	Replaced by D16R2421
	D8R2421	2421A
	D16R2421	LE85!, 275!, 2420!, 5A355!, 2421B
	D8R2425	LE85!, 2470!, 2421!, 2420!, 2425H,, 2426H, 2427H
	D16R2425	LE85!, 2470!, 2421!, 2420!, 2425J, 2426, J2427H
	D16R2440	375, 375H, 2440, 5A360, MI11427
	D16R2441	2445J, 2441, 2440, 375, 375H, 376
	D16R2445	2445J, 2441, 2440, 375, 375H, 376
	D16R2460	LE100S, LE175HP, 2460, 5P350
	D16R2470	2461, 5P355, 2470
D	(D16R2480)	Replaced by D16R2482
	D16R2482	2480, 2482, 2485

NOTES:

D - Recently discontinued, use indicated replacement.

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! - Closest substitute available, original assemble not produced.

UREI SYSTEMS REFERENCE CHART

MODEL	ENCLOSURE	LOW FREQUENCY	CO-AX	NETWORKS	HORN	Grilles	NOTES
U809	U25-14608		U803	U842	U45-14610	U809G	
U809A	U25-14608		U803	U842	U45-14610	U809GA	
U811	U25-13176-(*)		U801A (N/A)	U828	U45-12702-2	U811G	*2 = Left Enclosure 1 = Right Enclosure
U811A	U25-13176-(*)		U801AA (N/A)	U829	U45-13580	U811GA	*2 = Left Enclosure 1 = Right Enclosure
U811B	U25-13176-(*)		U801B	U830	U45-14053	U811GB	*2 = Left Enclosure 1 = Right Enclosure
U811C	U25-15416		U801C	U844	U45-14926	U811GC	
U813	U25-12787-(*)	U800W	U801A (N/A)	U838	U45-12702-2	U813G	*2 = Left Enclosure 1 = Right Enclosure
U813A	U25-12787-(*)	U800W	U801AA (N/A)	U839	U45-13580	U813GA	*2 = Left Enclosure 1 = Right Enclosure
U813B	U25-12787-(*)	U800W	U801B	U840	U45-14053	U813GB	*2 = Left Enclosure 1 = Right Enclosure
U813BX	U25-14488-(*)	2234H	U801B	U841-(L/R)	U45-10453	U813GX	*1 = Left Enclosure 2 = Right Enclosure
U813C	U25-15052-(*)	2215H	U801C	U843	U45-14926	U813GC	*2 = Left Enclosure 1 = Right Enclosure
U815	U25-1327(*)	U802W	U801A (N/A)	U848	U45-12702-2	U815GB	*1 = Left Enclosure 0 = Right Enclosure
U815A	U25-1327(*)	U802W	U801AA (N/A)	U839+Trap	U45-13580	U815GB	*1 = Left Enclosure 0 = Right Enclosure
U815C	U25-15287-(*)	2215J	U801C	U845	U45-13926	U815GC	*1 = Left Enclosure 0 = Right Enclosure

UREI SYSTEMS REPAIR CHART

TRANSDUCER	CONE REPLACEMENT KIT	DIAPHRAGM REPLACEMENT KIT	NOTES
U800W	U800WRC		
U801A	U801RCA	U801DA	Co-ax
U801AA	U801RCA	U801DA	Co-ax
U801B	U801RCB	D8R2525	Co-ax
U801C	C8RU801C	D8R2425	Co-ax
U802	U802WRC		
U803	C8RU803	D8R2416	Co-ax
2215H	C8R2215		
2215J	C16R2215		
2234H	C8R2235		Do not use mass ring

AUTOMOTIVE TRANSDUCER PARTS LIST

MODEL	DESCRIPTION	LOW FREQUENCY	MID FREQUENCY	HIGH FREQUENCY	STANDARD GRILLES	IMPEDENCE	NOTES
2105	5" Mid/high frequency	C8RLE59			N/A	8 ohms	
A15	51/4" 2-Way	C4RA15			N/A	4 ohms	
A30	6X9 2-Way	C4RA30			N/A	4 ohms	
ER/G 410	4 X 10 Dual element	N/A			N/A	4 ohms	
ER/G 690	6 X 9 Dual element	N/A			N/A	4 ohms	
ER/G4.5	41/2" Dual element	N/A			N/A	4 ohms	
ER/G6.5	61/2" Dual element	N/A			N/A	4 ohms	
LE8T-H	8" Full range	C8RLE8T-H	N/A		N/A	8 ohms	
LE10H-1	10" Low Frequency	C8RLE10H-1	N/A		N/A	8 ohms	
LT-1	9 3/4 X 6 3/8 X 5" 2-Way	C8RLT-1	D4R024		GRLT-1	4 ohms	Miniature loudspeaker system
T05	1" High frequency			N/A	N/A	4 ohms	
T50	5" Mid/low frequency.				GT50	4 ohms	
T55	5" 2-Way				GT55	4 ohms	
T60	6.5" Mid/low frequency.				GT60	4 ohms	
T65	6.5" 2-Way				GT65	4 ohms	
T75	2-Way plate speaker	N/A			N/A	4 ohms	
T80	8" Low frequency	C8R116H-1			GT80	8 ohms	
T90	6 X 9" Low frequency	C4RT950			GT90	4 ohms	
T95	6 X 9" 3-Way	C4RT950		HFRT950	GT95	4 ohms	
T100	10" Low frequency	C8R127H-1			GT100	8 ohms	
T105	3 1/2" Dual cone	N/A			N/A	4 ohms	
T115	4 X 6 Dual cone	N/A			N/A	4 ohms	
T115M	4 X 6 Dual cone	N/A			N/A	4 ohms	

AUTOMOTIVE TRANSDUCER PARTS LIST

MODEL	DESCRIPTION	LOW FREQUENCY	MID FREQUENCY	HIGH FREQUENCY	STANDARD GRILLES	IMPEDENCE	NOTES
T205	4 1/2" 2-Way	C4RT205		HFRT205	GRT205	4 ohms	
T420	6 1/2" 2-Way	C4RT420		HFRT420	GRT420	4 ohms	
T425	6 1/2" 3-Way	C4RT420		HFRT425	GRT425	4 ohms	
T540	6 X 9" 2-Way	C4RT950		HFRT540	GRT540	4 ohms	Optional grille – model number G540
T545	6 X 9" 3-Way	C4RT950		HFRT545	GRT545	4 ohms	Optional grille – model number G545
T550	5" 2-Way				GT550	4 ohms	
T650	6.5" 2-Way				GT650	4 ohms	
T950	6 X 9," 3-Way	C4RT950		HFRT950	GT950	4 ohms	
TL-500	5" 2-Way					4 ohms	Single Pack Replacement #TL-500S
TL-600	6.5" 2-Way					4 ohms	Single Pack Replacement #TL-600S
TL-900	6 X9" 2-Way					4 ohms	Single Pack Replacement #TL-900S

MISCELLANEOUS PARTS REFERENCE CHART

PART DESCRIPTION	PART NUMBER	USED IN
Allen Wrench (Hex Key)	65697	2404H
Baffle Mount Screw 10 - 32 x 1 Fil	21754	PR15C, 123A, PR300, 4612A, B212-C, L300-A
Baffle Mount Screw 10-32 X 5/8	21856	E145-8, E145-16, M46-8, M46-16,
Baffle Mount Screw 10-32 x 1 Fil	21754	4380-B, 4311B, 4311BWX, 4623, 4625, 4627, 4690, 4695, L150A, 4312
Baffle Mount/Speaker Wood Screw L100T, L80T,	33841	Performance Series, 4408, 4410, 4412, 4612OK, L60T
Baffle Mount/Speaker Wood Screw	62905	JBL62, JBL82, JBL630, JBL830, JBL940
Baffle Mount Screw 20 x 1	21857	2301, 2340
Binding Post - 5 - Way, Black	62755	250Ti, 240Ti, 120Ti, 18Ti, B460
Binding Post - 5 - Way, Red	62746	250Ti, 240Ti, 120Ti, 18Ti, B460
Binding Post - Black	63636	J216, J220, J320, J325, J350, 8216
Binding Post - Large - Black	33751	Pro Models
Binding Post - Large - Red	33750	Pro Models
Binding Post - Red	63635	J216, J220, J320, J325, J350, 8216
Binding Post - Small - Black	10244	Hi fi Models
Binding Post - Small - Red	10243	Hi fi Models
Binding Posts, Dual	68172	2225H/J
Bolt-HH 1/4-20 x 7/8"	35308	2355, 2350, 2345, 375AB, 375EX, 435OB, 4355, 2344, 4691, 2370, 4691B, 4660, MA25, 2440, 2480, 2482, 2441, 376, 2445J, 2485J
Cable Assembly - Black (Lead wire)	39118	LE175, LE85, 375, 2410, 2470, 375AB, 2425, 2445, 2482, 2475J
Cable Assembly - Red (Lead wire)	39119	LE175, LE85, 375, 2410, 2470, 375AB, 2425, 2445, 2482, 2475J
Corner Protector	59459	4727A, 4790A, 4612, 4691, 4628, 4695, 4623, 4625, 4780, 4680A, 4723, 4725, 4727, 4790, 4795
Corner Cap	68219	Performance-Series
Cover Screw - Dome Tweeter	55302	066
Cover Screw - Dome Tweeter	57696	033

MISCELLANEOUS PARTS REFERENCE CHART

PART DESCRIPTION	PART NUMBER	USED IN
Cover Screw - Dome Tweeter	59821	044
Cover Screw - Dome Tweeter	62905	044Ti
Cover Screw - Compression Driver	52601	LE175, LE85, 2410, 2420, 2470, 2461, 2421A, 2421B
Cover Screw - Compression Driver	52602	375, 2440, 2480, 2482, 375AB, 375EX, 376, 2441, 376
Damping Pad - Cover Assembly	60397	LE85, 2470
Damping Pad - Cover Assembly	60398	375, 2482, 375AB
Diaphragm Screw	32164	LE175, LE85, 375, 2440, 2410, 2420, 2480, 2470, 2482, 375AB, 2461, 375EX, 2441, 2425H, 2475J, 2425J, 376, 2421A, 2421B, 2555J, 2485J, 2415
Dowel Pin - Grille Peg	59266	C4430, C82, C103, C123, C133, C96, C4344, C4401, C15, C4435, CB460, C86, CB380, C216, C220, C320, C325, C350, C4660, C8216, C4301BWX, C4313BWX, C4315BWX
Dowel Pin - Grille Peg	59266	C4504WX, C4504, C4503A, C4506, C4506-3, C4510, C4509WX, C4513WX, C902, C99VX, C4509BWX, C4510BWX, C4503B-3, C4506B&BWX, C4504B, C4504BWX, C4513BWX, C40, C19, C220, C300, C150, C150A, C4345, C4355
Dowel Pin - Grille Peg	65394-01	All TLX models
Dowel Pin - GrillePeg	65394-02	All TLX models
External Lock Washer #6 (Star)	10049	E145-8&16, E151-8, E120-8&16, 2203H, 2202H, 2202J, E155-8, 2240G, 2240H, 2245H, 2425, 2445, 2475J, LE10H&H-1, MI10, MI12, MI12-1, MI15, 375, 2110, 2410, 2470, 2482, 375AB, E110-8&16, M12-8, M12-16, 2122H, 2121H, 128H, 2213H, E140-8&16, E130-8&16, E130-4
External Lock Washer #8 Cad (Star)	10048	4345, 4355, 3155, 4435, 4430, 3134, 3135, 4344, 3109
Foam Plug	60925	LE14H, E145-8&16, 136H, 2231H, LE15H, 2235H, 2234H, 121H, 2203H, E140-8&16, 2205J, 2225H&J, E120-8&16, 2202H, 2202J, D130H, E130-4-8&16, 2220H&J, 2205H, E151-8, 2245H, M22-8, M32-4&8, M42-8, M46-8, E155-8, M22-16, 2240H, LE14H-1
Gasket, Vinyl	20253	12 and 14"
Gasket, Vinyl	21769	8"

MISCELLANEOUS PARTS REFERENCE CHART

PART DESCRIPTION	PART NUMBER	USED IN
Gasket, Vinyl	21770	10"
Gasket, Vinyl	21771	5"
Gasket, Vinyl	34499	15"
Gasket, Vinyl	51273	18"
Grille Retainer	62130	C46, C56, C4411L, C4411R
Grille Retainer	65840	240Ti, 250Ti, J216A, J220A, J320A, J325A, J350A, 120Ti, 18Ti
Grille Retainer	66815	L20T, L60T, L80T, L100T
Grip Fastener	59452	C4602, C4780A, C4680, C4695, C4612, C4691, C4628, C4620CVR, C4620CVR, C4602CVR, C4680CVR, C4612CVR, C4295CVR, C4702, C4702A, C4780, C4723, C4725, C4727, C4790, C4795, C4695, C4727A, C4790A, C4680A
Handle	68638	Performance-Series
Hook Fastener(Lenses)	48949	C91, 2308, 2325, G4345, G200-Cloth, G88-Cloth
Inner Horn, Acrytic	52554	077, 077H
Inner Horn, Black	47523	2405, 2405H
Inner Horn, Polished Silver Bullet	21732-0086	075, 2402, 075R, 2402H, 075H, 2402H-05
Knob - Network - Black	10293	LX5, LX11, 3110A, 3115A, 3120A
Knob - Network - Black	10330	N2400, N7000, N8000
Knob - Network - Black	52192	3107, N333, 3114A-1, 3133A, 3143, 3103, N212, N40, N50, N96, N112, N150A, 3155, N905VX, 3134, 3135, N133, N112-1, N150A-B
Knob - Network - Black	53027	N15, N16, N19, N220, LX300
Knob - Network - Black	55630	N4628, N4691, N4612, N4620B, N4623B
Knob - Network - Finished Gray	47179	3110, 3115, 3120
Knob - Network - Gray	47075	3105, 3106
Knob - Network	52908	3111, 3112, 3112B, 3112C, 3109
Knob	62572	4401
L-Pad - Potentiometer 8 ohm/10 W	10285	Various Models/Low Power

MISCELLANEOUS PARTS REFERENCE CHART

PART DESCRIPTION	PART NUMBER	USED IN
L-Pad - Potentiometer 8 ohm/30 W	58450	Various Models/Medium Power
L-Pad - Potentiometer 16 ohm/100 W	51594	Various Models/High Power
Logo	68606	Performance Series
Logo Medallion, Silver on Black	57810	G15, G46, G56, G82, G86, G96, G100-Cloth, G103, G112, G123,G133,G88-Cloth, G200-Cloth,GJ216,GJ216A, GJ320, GJ320A, GJ220, GJ220A, GH325, GJ325A, GJ350, GJ350A, G380, GB350, G18Ti, G120Ti, G240Ti, G4660
Logo Plate, White on orange	56321	Cabaret Series
Logo Retainer	52100	Cabaret Series
Logo Screw 6/32 X 5/8	63059-1	A212-C, 4313BWX, L112, 4411
Logo W/Stud	32411	G19, G40, G50, G150, G212, G220, G222, G300, MI-631
Mounting Clamp, Painted	60958-01	MA15, 4530, 4520, 4331B, 4333, 4345, 4355, 4435, 4430, 4344, B460, B380
Mounting Flange	51781	075, 2405, 077, 2402, 2402H, 075H, 2405H, 077H, 2402H-05
Network Cover (Plastic Board)	64462	NMI631/NMI632 (Use Silicone Base Adhesve)
Nylon Insulator Washer - Frame Assembly	21799	D208, 2110, LE5H, 2105H, LE25
Nylonl nsulator Washer -#6-Black	10871	LX5, N2400, N7000, LX11, LE175, LE85, 375, 075, 3125, 2410, 2470, 2482, 3110, 3120, 3105, 3115, 375AB, N8000, 3106, 3110A, 3115A, 3120A
Outer Horn	62361	2404H, 2404H-1
Pigtail-Waxed	24038/52354	116A, 117H, 108H, 2118H, 2118J, 115H, 115H-1, 119H
Rear Gasket - 18"	51273	18"-4695, 4795, 4345, B460, C4RK151, C8RE151, C8RE155, C8RK151, 4695B
Rear Gasket- White Cork	51179	15" E145-8 & 16
Retainer Screen Gasket	60752	044
Retainer Screen Gasket	62664	044-1, 044TI-1, 044TI, 034
Screen - Black	62711	044-1, 044TI, 044TI-1
Screen - Pot Assembly	34051	375, 2482, 375AB, 375EX
Screen - Sleeve Assembly	21399	LE175

MISCELLANEOUS PARTS REFERENCE CHART

PART DESCRIPTION	PART NUMBER	USED IN
Screen	60424	034, 044
Screw 8 - 32x1 - 1/4 Phillips Head Black	52014	075, 2405, 077, 2402, 2404H
Solder Lug #6	21910	D208, 2110, 112H, 2108H, 2118H&J, 2121H, 2122H, 2115, 2215H&J, 2205H&J 2202H&J, 2203H, 2220H&J, 2225H&J, 2231H, 2234H, 2240H, 2235H, LE10H,LE10H-1, LE111H, 2245H, LE14H, LE15H, 136H, ALL MI-SERIES ALL E - SERIES
Solder Lug	21765	LE20, LE20-1, All UHF
T-nut - 1/4-20 X 9/16	210904	C44, MA15, 2345, 2350, 2340, 4550, 2301, 2395, MA25, HL87, 123A, 2901A, 4627A, 4435, 2370, 2380, 2385, 4540, 460, 380, 4691, 4344, 4345, 4355, 4430, 4520, 4515, 2386, 4612OK, 4560, 4660, 2366H
T-nut - 10-32 x 33/64	21955	2397, 2395, PR15C, 123A, 4518, 4507, 4312
Terminal Board	52348	125A, 116A, 117H, 118H, 127H
Terminal Board	53225	LE5-1, LE5-11, LE5-6, LE5-10, LE5-9, LE5-12, 104H
Terminal Cup	66414	4312A, 4406, 4408, 4410, 4412
Twist Terminal - Binding Post - Black	56130	212E, L100, L19, L50, R502, 702, L110-A, L150A, L112, R82, R123, L56, L15, L46, L86, L112
Twist Terminal - Binding Post - Red	56131	212E, L100, L19, L50, R502, 702, L110-A, L150A, L112, R82, R123, L56, L15, L46, L86, L112

REFERENCE INFORMATION TABLE OF CONTENTS

Hi Fi Systems Chart

MODEL	ENCLOSURE	LOW	MID	HIGH	ULTRA HIGH	PASSIVE	NETWORKS	HORNS	LENS	NOTES
18TI	C18TI	115H-1		044TI			N18TI			
55VX	C55	308G	303G				N55VX			Export/Radiance
77VX	C77VX	310G	305G	303G			N77VX			Export/Radiance
99VX	C99VX	312G	305G	303G			N99VX			Export/Radiance
120TI	C120TI	128H-1	104H	044TI			N120TI			
240TI	C240TI	LE14H-1	104H	044TI			N240TI			
250TI	C250TI	LE14H-1	108H	104H	044TI-1		N250TI			
502VX	C502	308G		303G			N502VX			Radiance Series
502VXA	C502	308G		303G-1			N502VX			Radiance Series
702VX	C702	310G	305G	303G			N702VX			Radiance Series
702VXA	C702	310G	305G	303G-2			N702VX			Radiance Series
902VX	C902	312G	305G	303G			N902VX			Radiance Series
902VXA	C902	312G	305G	303G-2			N902VX			Radiance Series
905VX	C905	310G	305G	303G-2		PR310	N905VX			Radiance Series
4312	C4312(L,R)	2213H	LE5-12	LE25-2			3112C			Sold In Mirror Imaged Pairs
4312A	C4312A(L,R)	2213H	104H-3	035TI			3112D			Sold In Mirror Imaged Pairs
4344(L,R)	C4344(L,R)	2235H	2122H	2425J	2405H		3145	2307	2308	
A212	CA212	112A	LE5-9	066			N212			L212 Columns
A212C	CA212C	112H	LE5-9	066			N212			L212 Columns
AC800BK	CTLX 1	65437		65408			NAC800BK			Powered Speaker
Auto Display T	CAuto Display T	T950	T650	T550						Europe Only
Auto Display TL	CAuto Display TL	TL900	TL600	TL500						Europe Only
B212	CB212	121A					212E AMP			L-212 SUBWOOFER
B212C	CB212	121H					212E AMP			L-212 SUBWOOFER

Hi Fi Systems Chart

MODEL	ENCLOSURE	LOW	MID	HIGH	ULTRA HIGH	PASSIVE	NETWORKS	HORNS	LENS	NOTES
B380	C380	2235H								
B460	C460	2245H								
Control 1	C1001	C1003		C1002			C1006			
Control 3PRO	P1001	P1003		P1002			P1006			
Control 5	C5001	C5003		C5002			C5006			
Control 10L/R	69478-01	69493	305HS	037TIS			70605-8			
Control 12SR	69478-03	G125B-8		2416H			70605-8	2372		
D30085	C30	150-4C		375			N400	537	509	Hartsfield
D44000WX	C44WX	150-4C (2)	375 (2)	075 (2)			LX5 (2) N7000 (2)	H5038P (2)		Early Paragon
D44000WX	C44WX	LE15A (2)	375 (2)	075 (2)			LX5 (2) N7000 (2)	H5038P (2)		Paragon
D44000WXA	C44WXA	LE15H (2)	376 (2)	075 (2)			LX5 (2) N7000 (2)	H5038P (2)		Paragon
DD55000RX	CDD55000XRX	150-4H	2425H	2405H			NDD55000	2346-1		Project Everest
J216	C216	310G-2		010			NJ216			
J216A	CJ216A	306G-3		TLX012			NJ216A			
J220	C220	308G-2		011			NJ220			
J220A	CJ220A	308G-3		TLX012			NJ220A			
J320	C320	308G-2	305G-3	011			NJ320			
J320A	CJ320A	308G-3	305G-3	TLX012			NJ3XXA			
J325	C325	3105G-2	305G-2	011			NJ325			
J325A	CJ325A	310G-3	305G-3	TLX012			NJ3XXA			
J350	C350	310G-2	305G-2	011		PR310-2	NJ350			
J350A	CJ350A	310G-3	305G-3	TLX012		PR310G-3	NJ3XXA			
JBL62	67283	306G-4		TLX-1			NJBL62			

Hi Fi Systems Chart

MODEL	ENCLOSURE	LOW	MID	HIGH	ULTRA HIGH	PASSIVE	NETWORKS	HORNS	LENS	NOTES
JBL82	67284	308G-4		TLX-1			NJBL82			
JBL630	67285	306G-4(2)		TLX-2			NJBL630			
JBL830	67286	308G-4(2)		TLX-2			NJBL830			
JBL940	67287	310G-4(2)	305G-4	TLX-2			NJBL940			
L15	C15	115H		034			N15			
L16	C16	116A		LE25-2			N16			Decade 16
L19	C19	116A		LE26			N19			
L19A	C19A	116H		LE26			N19			
L20T	C20T	115H-1		035TI			NL20T			
L25	C25	125A		LE25			N25			Prima
L26	C26	125A		LE25-2			N26			Decade 26
L26A	C26A	125A		LE25-4			N26-A			Decade 26
L33	C33	LE8								Lancer 33
L36	CL36	125A	LE5-6	LE25-2			N36			Decade 36
L36-A	CL36-A	125A	LE5-6	LE25-4			N36			Decade 36
L40	CL40	127A		033			N40			
L40-A	CL40-A	127H		033			N40			
L44	CL44WX	LE8T				PR8				Lancer 44
L45	CL45	130A		LE175			N1200	H91	L91	Flair
L45-A	CL45A	135A	LE5-5	LE25			LX18			Flair
L45B	CL45B	135A	LE5-5	LE25			LX18			Flair
L46	C46	117H-1		034			N46			Sigma
L50	CL50	127A	LE5-10	LE26			N50			
L50A	CL50A	127H	LE5-10	LE26			N50			

HI FI Systems Chart

MODEL	ENCLOSURE	LOW	MID	HIGH	ULTRA HIGH	PASSIVE	NETWORKS	HORNS	LENS	NOTES
L54	C54	LE8T				PR8				Trimline
L55	CL55	LE14A		LE20-1			LX15			Lancer 55
L55A	CL55A	123A-1	LE5-5	077			N55			Lancer 55A
L56	C56	118H		034			N56			
L57	C57	D280				PR8				Carnival
L59	C57	LE8T				PR8				Carnival
L60GI	C60GI	116H-1		O35TI			NL60GI			
L60T	C60T	116H-1		O35TI			NL60T			
L65	CL65	126A	LE5-5	077			N65			Jubal
L65A	CL65-A	122A	LE5-5	077			N65-A			Jubal
L65B	CL65-B	129H	LE5-5	077			N65-B			Jubal
L66	C66	LE10		LE20-1			NO NUMBER			Lancer 66
L71	C71	135A	LE5-3	LE25			LX17			Verona
L71-A	C71-A	135A	LE5-3	LE25			LX17-A			Verona
L75	C75WX	LE8T				PR8				Minuet
L77	C77	LE10A	LE20-1			PR10	LX4-2			Lancer 77
L80	C80	LE8T				PR8				Caprice
L80GI	C80GI	127H-1	104H-2	035TI			NL80GI			
L80T	C80T	127H-1	104H-2	035TI			NL80T			
L86	C86	117H-1	LE5-12	034			N86			
L88	C88WX	123A-1		LE20-1			LX12-1			Nova
L88-1	C88-1WX	123A-1		LE20-1			LX12-1			Cortina
L88-A	C88WX-A	123A-1		LE25			N88-1			Nova
L88P	C88P	123A-1		LE25			N8888			Plus

Hi Fi Systems Chart

MODEL	ENCLOSURE	LOW	MID	HIGH	ULTRA HIGH	PASSIVE	NETWORKS	HORNS	LENS	NOTES
L88P-A	C88P-A	123A-1		LE25			N8888			Plus
L96	C96	LE10H-1	LE5-12	044			N96			Delta
L100	CL100	123A-1	LE5-2	LE20-1			LX-12-10			Century
L100A	CL100A	123A-1	LE5-2	LE25			N100			Century
L100A(LATE)	CL100A	123A-3	LE5-2	LE25			N100			Century
L100GI	CL100T	2214H	104H-2	O35TI			NL100GI			
L100T	C100T	2214H	104H-2	O35TI			NL100T			
L101	C101WX	LE14A	175DLH				LX10	1217	1290	Lancer 101
L110	CL110	LE111A	LE5-10	033			N110			
L110A	CL110A	LE111H	LE5-10	033			N110			
L112	C112	128H	LE5-12	044			N112			Century II
L120	C120	125A	LE5-6	LE25-3			N120Q			Aquarius Q
L120-A	C120-A	125A	LE5-6	LE25-5			N120Q			Aquarius Q
L150	C150	128H	LE5-10	033		PR300	N150			Millenium
L150A	C150-A	128H	LE5-12	044		PR300	N150A			Millenium
L150A-B	C150-A	128H	LE5-12	044		PR300	N150B			Millenium
L166	C166	122A	LE5-8	066			N166			Horizon
L166-A	C166-A	122A-1	LE5-8	066			N166-1			Horizon
L200	C200	LE15B		LE85			LX16	H91	L91	Studio Master
L200-A	C200	LE15B		LE85			LX-16-A	H91	L91	Studio Master
L200B	C200B	136A		LE85			N200B	H91	L91	Studio Master
L220	C220	LE14A	LE5-9	076		PR15C	N220		L94	Oracle
L220A	C220A	LE14H	LE5-9	076		PR15D	N220		L94	Oracle
L222	C222	LE14A	LE5-9	076		PR15C	N220		L94	Disco

HI FI Systems Chart

MODEL	ENCLOSURE	LOW	MID	HIGH	ULTRA HIGH	PASSIVE	NETWORKS	HORNS	LENS	NOTES
L54	C54	LE8T				PR8				Trimline
L55	CL55	LE14A		LE20-1			LX15			Lancer 55
L55A	CL55A	123A-1	LE5-5	077			N55			Lancer 55A
L56	C56	118H		034			N56			
L57	C57	D280				PR8				Carnival
L59	C57	LE8T				PR8				Carnival
L60GI	C60GI	116H-1		O35TI			NL60GI			
L60T	C60T	116H-1		O35TI			NL60T			
L65	CL65	126A	LE5-5	077			N65			Jubal
L65A	CL65-A	122A	LE5-5	077			N65-A			Jubal
L65B	CL65-B	129H	LE5-5	077			N65-B			Jubal
L66	C66	LE10		LE20-1			NO NUMBER			Lancer 66
L71	C71	135A	LE5-3	LE25			LX17			Verona
L71-A	C71-A	135A	LE5-3	LE25			LX17-A			Verona
L75	C75WX	LE8T				PR8				Minuet
L77	C77	LE10A	LE20-1			PR10	LX4-2			Lancer 77
L80	C80	LE8T				PR8				Caprice
L80GI	C80GI	127H-1	104H-2	035TI			NL80GI			
L80T	C80T	127H-1	104H-2	035TI			NL80T			
L86	C86	117H-1	LE5-12	034			N86			
L88	C88WX	123A-1		LE20-1			LX12-1			Nova
L88-1	C88-1WX	123A-1		LE20-1			LX12-1			Cortina
L88-A	C88WX-A	123A-1		LE25			N88-1			Nova
L88P	C88P	123A-1		LE25			N8888			Plus

Hi Fi Systems Chart

MODEL	ENCLOSURE	LOW	MID	HIGH	ULTRA HIGH	PASSIVE	NETWORKS	HORNS	LENS	NOTES
L88P-A	C88P-A	123A-1		LE25			N8888			Plus
L96	C96	LE10H-1	LE5-12	044			N96			Delta
L100	CL100	123A-1	LE5-2	LE20-1			LX-12-10			Century
L100A	CL100A	123A-1	LE5-2	LE25			N100			Century
L100A(LATE)	CL100A	123A-3	LE5-2	LE25			N100			Century
L100GI	CL100T	2214H	104H-2	O35TI			NL100GI			
L100T	C100T	2214H	104H-2	O35TI			NL100T			
L101	C101WX	LE14A	175DLH				LX10	1217	1290	Lancer 101
L110	CL110	LE111A	LE5-10	033			N110			
L110A	CL110A	LE111H	LE5-10	033			N110			
L112	C112	128H	LE5-12	044			N112			Century II
L120	C120	125A	LE5-6	LE25-3			N120Q			Aquarius Q
L120-A	C120-A	125A	LE5-6	LE25-5			N120Q			Aquarius Q
L150	C150	128H	LE5-10	033		PR300	N150			Millenium
L150A	C150-A	128H	LE5-12	044		PR300	N150A			Millenium
L150A-B	C150-A	128H	LE5-12	044		PR300	N150B			Millenium
L166	C166	122A	LE5-8	066			N166			Horizon
L166-A	C166-A	122A-1	LE5-8	066			N166-1			Horizon
L200	C200	LE15B		LE85			LX16	H91	L91	Studio Master
L200-A	C200	LE15B		LE85			LX-16-A	H91	L91	Studio Master
L200B	C200B	136A		LE85			N200B	H91	L91	Studio Master
L220	C220	LE14A	LE5-9	076		PR15C	N220		L94	Oracle
L220A	C220A	LE14H	LE5-9	076		PR15D	N220		L94	Oracle
L222	C222	LE14A	LE5-9	076		PR15C	N220		L94	Disco

Hi Fi Systems Chart

MODEL	ENCLOSURE	LOW	MID	HIGH	ULTRA HIGH	PASSIVE	NETWORKS	HORNS	LENS	NOTES
L222A	C222	LE14H	LE5-9	076		PR15C	N220		L94	Disco
L250	C250	LE14H-1	108H	LE5-11	044-1		N250			
L300	C300	136A	LE85	077			N333	H92	L92	Summit
L300A	C300A	136H	LE85	077			N333	H92	L92	Summit
LX22	CLX22	405		026TI			NLX22			NLX22GI Network For GI Model
LX44	CLX44	408	406	026TI			NLX44			NLX44GI Network For GI Model
LX55	CLX55	410	405	026TI			NLX55			NLX55GI Network For GI Model
LX66	CLX66	408(2)	405	026TI			NLX66			NLX66GI Network For GI Model
LX144	CLX144	408	405	026TI			NLX144			
LX155	CLX155	410	405	026TI			NLX155			
LX166	CLX166	408(2)	405	026TI			NLX166			
R82	C82	308G-1		LE25-2			N82			Radiance
R103	C103310G-1	305G-1		LE25-2			N103			Radiance
R123	C123	312G-1	305G-1	LE25-2			N123			Radiance
R133	C133	310G-1	305G-1	LE25-2		PR310-1	N133			Radiance
S36	C36WX	130A		LE175			N1200	1217	1290	Viscount
S38	C38WX	D130		075			N2400			Baron
S51	C51	LE15A		LE85			LX5	H91	L91	Apollo
S56	C56-9	LE14A		LE20-1			LX8			Dorian
S61K	C61K	LE15A		LE85			LX5	H91	L91	Sovereign II
S61P	C61P	LE15A		LE85			LX5	H91	L91	Sovereign II
S70	C70WX	123A-1	LE5-2	LE20-1		PR12	No Number			Alpha III
S99	C99WX	LE14A		LE20-1			LX4-1			Athena
S101	C101	2214H		2416H			N101	2371		

HI FI Systems Chart

MODEL	ENCLOSURE	LOW	MID	HIGH	ULTRA HIGH	PASSIVE	NETWORKS	HORNS	LENS	NOTES
S105	C105	LE10A	LE5-3	LE20-1			LX12-2			Aquarius I
S106	C106	123A-2	LE5-2 (2)	LE20-1			LX12-5			Aquarius II
S109	C109	LE8T-2		LE20-1			LX12-7			Aquarius
S507	C50	LE15A		LE85		PR15	LX5	H91	L91	Olympus
S508	C50	LE15A	375	075		PR15	LX5/N7000	H93	L91	Olympus
S607	C60	LE15A		LE85		PR15	LX5	H91	L91	Sovereign I
S608	C60	LE15A	375	075		PR15	LX5/N7000	H93	L91	Sovereign I
SC99	C99WX	LE14A		LE20-1			LX4-1			Athena
SLT-1	CLT-1	C8RLT-1		024			NLT-1			With bracket
TLX2	CTLX2	65436LY		65408LY			NTLX2			
TLX3	CTLX3	65436LY		65408LY			NTLX3			
TLX4	CTLX4	65435LY		65408LY			NTLX4			
TLX6	CTLX6	65435LY	65437LY	65408LY			NTLX6			
TLX7	CTLX7	65435LY	65437LY	65408LY			NTLX7			
TLX8	CTLX8	65434LY	65437LY	65408LY			NTLX8			
TLX9	CTLX9	65434LY	65437LY	65408LY			NTLX9			
TLX10	CTLX10	65434LY	65437LY	65408LY		65433-1LY	NTLX10			

Hi Fi Separate Systems Reference Chart

MODEL	LOW	MID	HIGH	PASSIVE	NETWORKS	HORN	LENS
001	130A		LE175		N1200	1217	1290
002	D123		075		N2400		
004	D123(4)		075		N2600		
022	D123		075		N2400		
020	D216		075		N2400		
026	D123(2)		075		N2600		
030	D130		075		N2600		
032	D123	LE20			LX2		
040	D130(2)		075		N2600		
050	130B(2)	LE175			N1200	1217	1290
080	150-4(2)	375			N400	537	500
081	150-4C	375			N400	537	500
082	150-4(2)	375			N400	H5038	
083	150-4(2)	375			N400	537	509
085	150-4C	375			N400	537	509
S1	LE14A	LE175			LX10	HL87	
S4	130A	LE175			N1200	H91	L91
S5*	LE10	LE30			LX3		
S6	LE15A		LE75		LX5	H91	L91
S7	LE15A	LE85			LX5	H91	L91
S7R	LE15A	LE85		PR15	LX5	H91	L91
S8	LE15A	375	075		LX5/N7000	H93	L91
S8R	LE15A	375	075	PR15	LX5/N7000	H93	L91
S9	LE10B	LE75			LX6	H91	L92
S10	LE10B	LE85			LX6	H91	L92
S11	LE10A	LE20	LX4-2				
S12	LE14A	LE20	LX8				
S18	LE15A	375	075		LX5/N700	1237	1290
S27	LE15A	LE85			LX13	H91	L91
S52	LE10A(2)	LE30(2)			LX3-0(2)		
S62	LE15A(2)	LE75(2)			LX5(2)	H5040(2)	
S72	LE15A(2)	LE85(2)			LX5(2)	H5040(2)	
S82	LE15A(2)	375(2)	075(2)		LX5(2)/N7000(2)	H5041(2)	
S92	LE14A(2)	LE175(2)			LX7(2)	H5040(2)	

Hi Fi Separate Systems Reference Chart

MODEL	LOW	MID	HIGH	PASSIVE	NETWORKS	HORN	LENS
201	130A(2)	LE175(2)			N1200(2)	H5040(2)	
202	D123(2)		075(2)		N2400(2)		
203	D130(2)						
205	130A(2)	275(2)			N600(2)	H5040(2)	
214	LE14C(2)				LX2-1(2)		
223	D123(2)						
230	D130(2)		075(2)		N2400(2)		
231	D131(2)						
282	150-4C(2)		375(2)		N400(2)	H5041(2)	

* Note S5 is also known as S5 Minigon System

201-282 is also known as Metregon System

The 205 Metregon System is the most common

Professional Systems Reference Chart

MODEL	ENCLOSURE	LOW FREQUENCY	MID FREQUENCY	HIGH FREQUENCY	ULTRA HIGH FREQUENCY	NETWORKS	HORN	LENS	NOTES
2901				2410		3101	2301		
2901A				2410		3101	2301		
2901A MI				2461		3101	2301		
2901B				2425J		3101A	2301		
2902				2402(2)		3102			
2902A				2402(2)		3102			
2903				2402		3104			
2903A				2402H		3104			
4301	4510	116A		LE25-2		3103			
4301B	4510B	116H		LE26		3103			
4301BE	4509B	116H		LE26		3103			Built in amplifier (6001)
4301E	4509	116A		LE25-2		3103			Built in amplifier (6001E)
4310 (LATE)	4501	2212	2105	LE20-1		3111			
4310	4501	123A-1	LE5-2	LE20-1		NO NUMBER			
4311	4511	2212	2105	LE25		3112			
4311A	4511-A	2213	LE5-2	LE25		3112A			
4311B	4511B	2213H	LE5-10	LE25-2		3112B			
4312	C4312	2213H	LE5-12	LE25-2		3112C			Sold in mirror imaged pairs

Professional Systems Reference Chart

MODEL	ENCLOSURE	LOW FREQUENCY	MID FREQUENCY	HIGH FREQUENCY	ULTRA HIGH FREQUENCY	NETWORKS	HORN	LENS	NOTES
4312A	C4312A	2213H	104H-3	035TI		3112D			Sold in mirror imaged pairs
4313	4513	LE111A	LE5-9	066		3113			
4313B	4513B	LE10H	LE5-9	066		3113B			
4315	4515	2203A	2108A	2105	2405	3114			Dual bass ports
4315A	4515-1-A	2203A	2108A	2105	2405	3114A			
4315B	4515B	2203H	2108H	2105H	2405	3114A			
4320	4502	2215B		2420		3110	2307	2308	
4325	4505	2216		2420		3122	2307	2308	
4325A	4505A	2216		2420		3122A	2307	2308	
4330	45030	2231A		2420		3130	2312	2308	Bi-amp only
4331	4503-1	2231A		2420		3131	2312	2308	
4331A	4503A-1	2231A		2420		3131A	2312	2308	Switchable for bi-amp
4331B	4503B-1	2231H		2420		3131A	2312	2308	Switchable for bi-amp
4332	4503-2	2231A	2420	2405		3132	2312	2308	Bi-amp only
4333	4503A	2231A	2420	2405		3133	2312	2308	
4333A	4503A-3	2231A	2420	2405		3133A	2312	2308	Switchable for bi-amp
4333B	4503B-3	2231H	2420	2405		3133A	2312	2308	Switchable for bi-amp
4340	4506-1	2231A	2121	2420	2405	3140	2307	2308	Bi-amp only
4341	4506-1	2231A	2121	2420	2405	3141	2307	2308	

Professional Systems Reference Chart

MODEL	ENCLOSURE	LOW FREQUENCY	MID FREQUENCY	HIGH FREQUENCY	ULTRA HIGH FREQUENCY	NETWORKS	HORN	LENS	NOTES
4343	4506-3	2231A	2121	2420	2405H	3143	2307	2308	Moveable panel
4343B	4506-B	2231H	2121H	2420	2405H	3143	2307	2308	Moveable panel
4344	C4344	2235H	2122H	2426H	2405H	3145	2307	2308	Sold in mirror imaged pairs
4345	C4345	2245H	2122H	2425H	2405	3145	2307	2308	Sold in mirror imaged pairs
4350	4504	2230(2)	2202A	2440	2405	3107	2311	2308	Bi-amp only
4350A	4504-A	2231A(2)	2202A	2440	2405	3107	2311	2308	Bi-amp only
4350B	4504-B	2231H(2)	2202H	2440	2405H	3107	2311	2308	Bi-amp only
4355	C4355	2235H(2)	2202H	2441	2405H	3155	2311	2308	Bi-amp only
4375	4575	2105(4)							
4375A	4575A	LE5-9(4)							
4380	4580	2110(4)		2105(2)		3108	2325		
4380A	4580A	2110(4)		2105(2)		3108	2325		
4380B	4580A	2110H(4)		LE5-9(2)		3108B	2325		
4401	C4401	115H		034		N4401			
4406	C4406	115H-1		035TI		N4406			
4408	C4408	116H-2		035TI		N4408			
4410	C4410	127H-1	104H-2	035TI		N4410			
4411	C4411	128H	LE5-9	044		3109			Sold in mirror imaged pairs
4412	C4412	128H-1	104H-2	035TI		N4412			

Professional Systems Reference Chart

MODEL	ENCLOSURE	LOW FREQUENCY	MID FREQUENCY	HIGH FREQUENCY	ULTRA HIGH FREQUENCY	NETWORKS	HORN	LENS	NOTES
4425	C4425	2214H		2416		N4425	2342		Sold in mirror imaged pairs
4430(EARLY)	C4430	2235H		2421A		3134	2344		Sold in mirror imaged pairs/switchable for bi-amp
4430 (LATE)	C4430	2235H		2426H		3134	2344		Sold in mirror imaged pairs/switchable for bi-amp
4435(EARLY)	C4435	2234H(2)		2421A		3135	2344		Sold in mirror imaged pairs/switchable for bi-amp
4435	C4435	2234H(2)		2426H		3135	2344		Sold in mirror imaged pairs/switchable for bi-amp
4602	4702	K120		2402		3104			
4602A	4702A	E120-8		2402		3104			
4602B	4702A	E120-8		2402H		N4602B			
4604(EARLY)	C4604	E140-8		2425J		N4691	2370A		
4604(LATE)	C4604	E140-8		2426J		N4691	2370A		
4604B(EARLY)	C4604B	E140-8		2425J		N4691	2370A		
4604B(LATE)	C4604B	E140-8		2426J		N4691	2370A		
4612	C4612	2118J(2)		2404H-1		N4612			
4612B	C4612	2118J(2)		2404H-1		N4612			
4612OK	C4612OK	2118J(2)		2404H-1		N4612			Oak vinyl enclosure
4621	4721	K130							
4621A	4721A	E130-8							
4622	4722	K120(2)							
4622A	4722A	E120-8(2)							

Professional Systems Reference Chart

MODEL	ENCLOSURE	LOW FREQUENCY	MID FREQUENCY	HIGH FREQUENCY	ULTRA HIGH FREQUENCY	NETWORKS	HORN	LENS	NOTES
4623	4723	E130-8		2402		3104			
4623B	4723	E130-8		2402		N4602B			
4625	4725	E140-8							
4625B	4725	E140-8							
4627	4727	E145-8		2410		3103A	2301		
4627A	4277A	E145-8		2425		3101A	2301		Switchable for bi-amp
4628	C4628	E145-8	2118H	2404H-1		N4628			
4628B	C4628	E145-8	2118H	2404H-1		N4628			
4645	4518	2245H							Use with 5235 and two 51-5138 crossover cards
4646	4512	2204H							
4647	4507	2225H							
4648	4508	2225H(2)							
4660(EARLY)	C4660	2225H		2425J		N4660	65120		
4660(LATE)	C4660	2225H		2426J		N4660	65120		
4662	4560BKA	K130		2461		3110	2345		
4662A	4560BKA	E140-8		2425J		3110A	2370		
4663	4560BKA	K130		2461	2405	3110 & 3106	2345		With 2504 bracket
4663A	4560 BKA	E140-8		2425J	2405H	3110A & 3105	2370		With 2504 bracket
4670(LATE)	4508	2225J(2)		2441		3152A	2390		

Professional Systems Reference Chart

MODEL	ENCLOSURE	LOW FREQUENCY	MID FREQUENCY	HIGH FREQUENCY	ULTRA HIGH FREQUENCY	NETWORKS	HORN	LENS	NOTES
4670	4508	E145-16(2)		2441		3152A	2390		
4670A	4508	2225J(2)		2445J		3152A	2380		
4670B	4508	2225H(2)		2445J		3160	2380A		
4671	4507	2225H		2425J		3110A	2370A		
4672(LATE)	4560BKA	2225H		2410		3110	2345		
4672	4560BKA	E145-8		2410		3110	2345		
4672A	4560BKA	2225H		2425J		3110A	2370A		
4673	4507	2225H		2445J		3115A	2380		
4674(LATE)	4560BKA	2225H		2441		3115	2350		Uses 2328 throat
4674	4560BKA	E145-8		2441		3115	2350		Uses 2328 throat
4674A	4560BKA	2225H		2445J		3115A	2380A		
4675	4508	2225J(2)		2445J		3152A	2360A		With 2506 bracket
4675A	4508	2225H(2)		2445J		3160	2360A		With 2506 bracket
4675A-2	4508	2225J(4)		2445J(2)		3160	2360A		With 2506 bracket
4676-1(LATE)	4550BKA	2225H(2)		2441		3152A	2350		Uses 2328 throat
4676-2(LATE)	4550BKA(2)	2225H(4)		2441(2)		3152A	2350		Uses 2329 dual throat and 9375 transformer
4676A-1	4550BKA	2225J(2)		2445J		3152A	2360A		With 2506 bracket
4676-1	4550BKA	E145-8(2)		2441		3152A	2350		Uses 2328 throat
4676A-2	4550BKA(2)	2225H(4)		2445J(2)		3152A	2365A		With 2506 bracket (2) and 9375 transformer

Professional Systems Reference Chart

MODEL	ENCLOSURE	LOW FREQUENCY	MID FREQUENCY	HIGH FREQUENCY	ULTRA HIGH FREQUENCY	NETWORKS	HORN	LENS	NOTES
4676-2	4550BKA(2)	E145-8(4)		2441(2)		3152A	2350		Uses 2329 dual throat and 9375 transformer
4676B-1	4550BKA	2225H(2)		2445J		3160	2360A		With 2506 bracket
4676B-2	4550BKA	2225J(4)		2445J(2)		3160	2365A		With 2506 bracket (2) and 9375 transformer
4680	4780	K110(4)		2404(2)		3102			
4680A	4780	E110-8(4)		2402(2)		3102			
4680B	C4680B	E110-8(4)		2402H(2)		3102			
4681	4781	K110(4)							Molded enclosure
4682	4782	K110(4)		2402(2)		3102			Molded enclosure
4690	4790	E140-8		2410		3101A	2306		
4690A	4790	E140-8		2425J		3101A	2306		
4691	C4691	E140-8		2425J		N4691	2370		
4691B	C4691B	E140-8		2425J		N4691	2370A		
4695	4795	E155							
4695B	C4695B	E155-8							
4695B-4	C4695B-4	E155-4							
4698	C4698	E155-4	E110-8	2404H-1		N4698			
4698B	C4698B	E155-4	E110-8	2404H-1		N4698			
4699	C4699	E155-4	E110-8	2425H		N4699	2370A		
4699B	C4699B	E155-4	E110-8	2425H		N4699	2370A		

Professional Systems Reference Chart

MODEL	ENCLOSURE	LOW FREQUENCY	MID FREQUENCY	HIGH FREQUENCY	ULTRA HIGH FREQUENCY	NETWORKS	HORN	LENS	NOTES
4825	C4825	2204H		2426J		Bi-amp	2344		Concert Series–Modified horn
4828	C4828	2204H		2426J		Bi-amp	2344		Concert Series–Modified horn
4842	C4842	2245H(2)							Concert Series
4845	C4845	2245H							Concert Series
4847	C4847	2225H							Concert Series
4850	C4850	2204H(2)		2445J		Bi-amp	2380A		Concert Series
4851	C4850	2204H(2)	2445J	2404H(2)		Tri-amp	2380A		Concert Series
4852	C4850	2204H(2)		2445J		Bi-amp	2385A		Concert Series
4853	C4850	2204H(2)	2445J	2404H(2)		Tri-amp	2385A		Concert Series
4860	C4860			2445J			2380A		Concert Series
4861	C4860		2445J	2404H(2)			2380A		Concert Series
4862	C4860			2445J			2385A		Concert Series
4863	C4860		2445J	2404H(2)			2385A		Concert Series
4866	C4866		2445J(2)				2386A		Concert Series
4870	C4870	2225H(2)		2445J		Bi-amp	2380A		Concert Series
4871	C4870	2225H(2)	2445J	2404H(2)		Tri-amp	2380A		Concert Series
4872	C4870	2225H(2)		2445J		Bi-amp	2385A		Concert Series
4873	C4870	2225H(2)	2445J	2404H(2)		Tri-amp	2385A		Concert Series
8216	C216BK	306G-2		010		NJ216			Black enclosure

Professional Systems Reference Chart

MODEL	ENCLOSURE	LOW FREQUENCY	MID FREQUENCY	HIGH FREQUENCY	ULTRA HIGH FREQUENCY	NETWORKS	HORN	LENS	NOTES
8216A	C216BK	306G-3		TLX012		NJ216			Black enclosure
8216AT	C216BK	306G-3		TLX012		NJ216			Black enclosure with 15 watt transformer
8325	C8325	310G-2	305G-3	011		J3XXA			Black enclosure
8325A	C8325A	310G-3	305G-3	TLX012		J3XXA			Black enclosure
8330	C8330	308G-3	305G-3	TLX(65408)		N8330			Surround and Foreground speaker
4671OK(EARLY	C4671OK	2225H		2425J		N4671OK	2370A		Tweeter polarity reversed
4671OK(LATE)	C4671OK	2225H		2426J		N4671OK	2370A		Tweeter polarity reversed
CONTROL 1	C1001	C1003		C1002		C1006			Network attached to input terminal
CONTROL 5	C5001	C5003		C5002		C5006			Network attached to input terminal
CONTROL 10L/R	69478-01	69493	305HS	037TIS		70605-8			
CONTROL 12SR	69478-03	G125-8		2416H		70605-8	2372		
G-730	CG-730	G-125-8		2416H		NG-730	2371		
G-732	CG-732	G-135A-8		2416H		NG-732	2371		
G-733	CG-733	MI-10-1	2118J-1	2416H		NG-733	2371		
G-734	CG-734	G-135A-8		2416H		NG-734	2371		
G-791				2416H		NG-791	2371		G-791/2371 Horn/driver combination Power pack is wired for use with low frequency unit
MI-261	CMI-261			2415H		NMI-261	2371		
MI-291				2415H		NMI-291	2371		MI-291/2371 Horn/driver Power pack is wired for use with low frequency unit

Professional Systems Reference Chart

MODEL	ENCLOSURE	LOW FREQUENCY	MID FREQUENCY	HIGH FREQUENCY	ULTRA HIGH FREQUENCY	NETWORKS	HORN	LENS	NOTES
MI-630	CMI-630	MI-12-1		2415H		NMI-630	2371		
MI-631	CMI-631	MI-12-1		2415H		NMI-631	2371		
MI-632	CMI-632	MI-15		2415H		NMI-632	2371		
MI-632A	CMI-632	MI-15A		2415H		NMI-632	2371		
MI-634	CMI-634	MI-15A		2415H		NMI-634	2371		
SLT-1	CLT-1	C8RLT-1		024		NLT-1			

JBL TRANSDUCER REPLACEMENT LIST

Transducer Model	Acoustic Equivalent	Visual Change	Baffle Modification	Category	Notes
033	034	Yes	No	(2)	Not safe for L40 or L110 systems
066	044	Yes	Yes	(2)	
075	2402H	Yes	No	(1)	
075R	2402H	Yes	No	(2)	
076	2405H	Yes	No	(3)	Altered dispersion characteristics
077	2405H	Yes	No	(1)	
112A	108H	Yes	No	(3)	Requires extensive network modification for L212 use
112H	108H	Yes	No	(3)	Requires extensive network modification for L212 use
116A	116H	Yes	No	(2)	
117H	117H-1	Yes	No	(1)	
121A	None				B212 Only
121H	None				B212 Only
122A	128H-1	Yes	No	(3)	
122A-1	128H-1	Yes	No	(3)	
123A	2213H	Yes	No	(2)	Reverse polarity
123A-1	2213H	Yes	No	(2)	Reverse polarity
123A-2	2213H	Yes	No	(2)	Reverse polarity
123A-3	2213H	Yes	No	(2)	
124A	128H-1	Yes	No	(3)	Or LE14H-1 w/baffle mod.
124H	128H-1	Yes	No	(3)	Or LE14H-1 w/baffle mod.
125A	118H	Yes	No	(2)	
126A	128H-1	Yes	No	(2)	
127A	118H	Yes	No	(2)	
127H	118H	Yes	No	(2)	

JBL TRANSDUCER REPLACEMENT LIST EXPLANATIONS

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Replacement transducers fall into the following categories:

1. Exact acoustic replacement.
2. Slightly different (usually improved) replacement.
3. Last resort.

*Both units in a stereo pair should be changed when using category 2 and 3 replacements.

*Considering the age of transducer to be replaced, category 1 replacements may also require changing both units of a stereo pair for best performance.

*Impedance changes have not been noted.

JBL TRANSDUCER REPLACEMENT LIST

Transducer Model	Acoustic Equivalent	Visual Change	Baffle Modification	Category	Notes
128H	128H-1	Yes	No	(1)	
129H	128H-1	Yes	No	(1)	
130A	2220H	Yes	No	(2)	
130B	2220J	Yes	No	(2)	
130H	2220H	Yes	No	(2)	
135A	2235H	Yes	No	(2)	
136A	2235H	Yes	No	(2)	
136B	2235H	Yes	No	(2)	
136H	2235H	Yes	No	(2)	
150-4	E145-8	Yes	No	(2)	
150-4C	E145-8	Yes	No	(2)	
150H	2234H	Yes	No	(3)	
275	2425J	Yes	No	(2)	
303G	303G-2	Yes	No	(2)	
303G-1	303G-2	Yes	No	(2)	
305G	305G-2	Yes	No	(2)	
305G-1	305G-2	Yes	No	(2)	
308G	308G-2	Yes	No	(2)	
308G-1	308G-2	Yes	No	(2)	
310G	310G-2	Yes	No	(2)	
310G-1	310G-2	Yes	No	(2)	
312G	312G-1	Yes	No	(2)	
375	2441	Yes	No	(2)	
375H	None				
376	2441	Yes	No	(1)	
2105	2105H	Yes	No	(2)	
2108	2118H	Yes	No	(2)	
2108H	2118H	Yes	No	(2)	

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Transducer Model	Acoustic Equivalent	Visual Change	Baffle Modification	Category	Notes
2110	2118H	Yes	No	(2)	
2110H	2118H	Yes	No	(2)	
2115	LE8T-H	Yes	No	(3)	Or 2118 w/ baffle mod.
2115A	LE8T-H	Yes	No	(3)	Or 2118 w/ baffle mod.
2115B	LE8T-H	Yes	No	(3)	Or 2118 w/baffle mod.
2115H	LE8T-H	Yes	No	(3)	Or 2118 w/baffle mod.
2115J	LE8T-H	Yes	No	(3)	Or 2118 w/baffle mod.
2120	E110-8	Yes	No	(2)	
2121	2122H	Yes	No	(2)	
2121H	2122H	Yes	No	(2)	
2125	2213H	Yes	No	(3)	
2130	E120-8	Yes	No	(2)	
2135	E130-8	Yes	No	(2)	
2145	None				
2150	None				Must be replaced with a 2-way system
2202A	2202H	Yes	No	(2)	
2202B	2202H	Yes	No	(2)	
2202J	2202H	No	No	(2)	
2203A	128H-1	Yes	No	(3)	Or LE14H-1w/baffle mod.
2203H	128H-1	Yes	No	(3)	
2205A	2225H	Yes	No	(2)	
2205B	2225J	Yes	No	(2)	
2205C	2225J	Yes	No	(2)	
2205H	2225H	No	No	(2)	

JBL TRANSDUCER REPLACEMENT LIST EXPLANATIONS

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Transducer Model	Acoustic Equivalent	Visual Change	Baffle Modification	Category	Notes
2205J	2225J	No	No	(2)	
2212	2213H	Yes	No	(2)	
2213	2213H	Yes	No	(2)	
2215	2234H	Yes	No	(3)	
2215A	2234H	Yes	No	(3)	
2215B	2234H	Yes	No	(3)	
2215H	2234H	Yes	No	(3)	
2216	2234H	Yes	No	(3)	
2220A	2220H	Yes	No	(2)	
2220B	2220J	Yes	No	(2)	
2220C	2220J	Yes	No	(2)	
2230A	2235H	Yes	No	(2)	
2231A	2235H	Yes	No	(2)	
2231H	2235H	No	No	(2)	
2290	None				
2295	None				
2402	2402H	Yes	No	(2)	
2403	2405H	Yes	No	(3)	Altered dispersion characteristics
2405	2405H	Yes	No	(2)	
2410	2426J	Yes	No	(2)	
2420	2426J	Yes	No	(2)	
2421	2426J	Yes	No	(2)	
2425H	2426H				
2425J	2426J				
2440	2441	No	No	(2)	Do not use the 2441 in the 4350 series without network mod.

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JBL TRANSDUCER REPLACEMENT LIST

Transducer Model	Acoustic Equivalent	Visual Change	Baffle Modification	Category	Notes
2441	2445J	Yes	Yes	(2)	
2460	2425J	Yes	No	(2)	
2461	2425J	Yes	No	(2)	
2470	2425J	Yes	No	(2)	
2480	2482	No	No	(2)	
2482	2445J	No	Yes	(2)	
D15S	E130-8	Yes	No	(2)	
D110F	E110-8	Yes	No	(2)	
D110F-6	E110-16	Yes	No	(2)	
D120	E120-8	Yes	No	(2)	
D120F	E120-8	Yes	No	(2)	
D120F-2	E120-8	Yes	No	(2)	
D120F-6	E120-16	Yes	No	(2)	
D123	E120-8	Yes	No	(2)	Reverse polarity
D123-3	E120-8	Yes	No	(2)	
D123F	E120-8	Yes	No	(2)	Reverse polarity
D130	E130-8	Yes	No	(2)	
D130F	E130-8	Yes	No	(2)	
D130F-2	E130-8	Yes	No	(2)	
D130F-6	E130-16	Yes	No	(2)	
D130H	E130-8	Yes	No	(2)	
D131	E120-8	Yes	No	(2)	
D131F	E120-8	Yes	No	(2)	
D140F	E140-8	Yes	No	(2)	
D140F-2	E140-8	Yes	No	(2)	
D140F-6	E140-16	Yes	No	(2)	
D175	2425J	Yes	No	(2)	
D204	2118H	Yes	No	(2)	Reverse polarity

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JBL TRANSDUCER REPLACEMENT LIST

Transducer Model	Acoustic Equivalent	Visual Change	Baffle Modification	Category	Notes
D208	2118H	Yes	No	(2)	Reverse polarity
D208H	2118H	Yes	No	(2)	Reverse polarity
D216	2118H	Yes	No	(2)	Reverse polarity
D260	2118H	Yes	No	(2)	Reverse polarity
D280	2118H	Yes	No	(2)	
E130-4	E130-8	No	No	(1)	
E151-8	E155-8	Yes	No	(2)	
HL180	2425J	Yes	No	(2)	
K110	E110-8	Yes	No	(2)	
K110-4	E110-8	Yes	No	(2)	
K110-16	E110-16	Yes	No	(2)	
K120	E120-8	Yes	No	(2)	
K120-4	E120-8	Yes	No	(2)	
K120-6	E120-16	Yes	No	(2)	
K120-16	E120-16	Yes	No	(2)	
K130	E130-8	Yes	No	(2)	
K130-4	E130-8	Yes	No	(2)	
K130-16	E130-16	Yes	No	(2)	
K140	E140-8	Yes	No	(2)	
K140-4	E140-8	Yes	No	(2)	
K140-16	E140-16	Yes	No	(2)	
K145	E145-8	Yes	No	(2)	
K145-4	E145-8	Yes	No	(2)	
K145-16	E145-16	Yes	No	(2)	
K151	E155-8	Yes	No	(2)	
K151-4	E155-8	Yes	No	(2)	
K151-16	E155-16	Yes	No	(2)	
LE5-2	LE5-9	Yes	No	(2)	

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Transducer Model	Acoustic Equivalent	Visual Change	Baffle Modification	Category	Notes
LE5-3	LE5-9	Yes	No	(2)	
LE5-6	LE5-12	Yes	No	(1)	
LE5-8	LE5-12	No	No	(1)	
LE5-10	LE5-12	Yes	No	(1)	
LE5H	LE5-9	No	No	(1)	
LE8	LE8T-H	Yes	No	(2)	
LE8-1	LE8T-H	Yes	No	(2)	
LE8-7	None				Passive radiator
LE8T	LE8T-H	Yes	No	(2)	
LE8T-2	LE8T-H	Yes	No	(3)	
LE8TX	LE8T-H	Yes	No	(3)	
LE10A	LE10H-1	Yes	No	(2)	
LE10B	LE10H-1	Yes	No	(2)	
LE10H	LE10H-1	Yes	No	(1)	
LE12C	None				Must be replaced with a 2-way system
LE14A	LE14H-1	Yes	No	(2)	
LE14A-2	LE14H-1	Yes	No	(2)	
LE14C	None				Must be replaced with a 2-way system
LE14H	LE14H-1	Yes	No	(2)	
LE15A	2234H	Yes	No	(3)	
LE15B	2234H	Yes	No	(3)	
LE15H	2234H	Yes	No	(3)	
LE20	LE25-2	Yes	Yes	(3)	
LE20-1	LE25-2	Yes	Yes	(3)	
LE21H	LE25-2	Yes	No	(2)	
LE25	LE25-2	Yes	No	(2)	

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Transducer Model	Acoustic Equivalent	Visual Change	Baffle Modification	Category	Notes
LE25-1	LE25-2	Yes	No	(2)	
LE25-3	LE25-2	Yes	No	(2)	
LE25-4	LE25-2	Yes	No	(2)	
LE25-5	LE25-2	Yes	No	(2)	
LE30	LE25-2	Yes	Yes	(3)	
LE75	2425J	Yes	No	(2)	
LE85	2425J	Yes	No	(2)	
LE100S	2425J	Yes	No	(2)	
LE111A	LE10H-1	Yes	No	(3)	
LE111H	LE10H-1	Yes	No	(1)	
LE175	2425J	Yes	No	(2)	
PR8	None				Passive radiator
PR10	None				Passive radiator
PR10F	None				Passive radiator
PR12	PR300	Yes	No	(2)	Requires tuning
PR14	None				Passive radiator
PR15	None				
PR15C	None				
PR15D	None				
PR15F	None				
PR15R	None				
PR300	PR310-1	Yes	No	(2)	
PR310	PR310-2	Yes	No	(2)	
PR310-1	PR310-2	Yes	No	(2)	

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Consumer Loudspeaker Component Series to Professional Series Substitution Cross-Reference

Networks

Consumer Model	Professional Model
LX5	3115A
LX10	None, Use 3120
LX13	3110A
LX14	None
LX30	None, Use 3110A and 3105
LX50A	None, Use 3115A
LX80	None, Use 3110A
LX200B	None, Use 3110A
LX300	None, Use 3110A and 3105
N1200	3120A
N2400	None
N7000	3105
N8000	None, Use 3105

Transducers

Consumer Model	Professional Model
D208	None
LE8T-H	Available
LE10H-1	Available
124H	None, Use 2213H OR 128H
LE14H-1	Available
135H	None, Use 2235H
LE15H	None, Use 2235H OR 2234H
130H	2220H
140-4H	E145
D130H	None, Use E130
LE5H	2105H
LE21H	LE25-2
075	2402H
076	None, Use 2405H
077	2405H
LE175	2410
LE85	None, Use 2426H
376	2441

Horn and Lens Assembles

Consumer Model	Professional Model
HL87	2301
HL88	None
HL89	2390
HL90	2395 (2382)
HL91	2307/2308
HL92	None
HL93	2311/2308

Diaphram Interchangability

MODEL	STANDARD DIAPHRAGM	POSSIBLE ALTERNATIVES
075	D8R075	D8R076, D16R2405
076	D8R076	D8R075, D16R2405
077	D16R2405	D8R075, D8R076
2402	D8R075	D8R076, D16R2405
2402H	D8R075	D8R076, D16R2405
2403	D8R076	D8R075, D16R2405
2403H	D8R076	D8R075, D16R2405
2404H	D162405	D8R075, D8R076
2404H-1	D8R075	D8R076, D16R2405
2405	D16R2405	D8R075, D8R076
2405H	D16R2405	D8R075, D8R076
LE85	D16R2420	D8R2421, D16R2421, D8R2425, D16R2470
LE100S	D16R2460	D8R2421, D16R2421, D8R2425, D16R2425, D16R2470
LE175	D16R2410	D8R2421, D16R2421, D8R2421, D8R2425, D16R2425, D16R2470
275	D16R2420	D8R2421, D16R2421, D8R2425, D16R2425, D16R2470
2410	D16R2410	D8R2421, D16R2421, D8R2425, D16R2425, D16R2470
2415	D8R2415	D8R2416
2416	D8R2416	D8R2415
2420	D16R2420	D8R2421, D16R2421, D8R2425, D16R2425, D16R2470
2421A	D8R2421	D16R2421, D8R2425, D16R2425, D16R2470
2421B	D16R2421	D8R2421, D8R2425, D16R2425, D16R2470
2425H	D8R2425	D16R2425, D8R2421, D16R2421, D16R2470
2425J	D16R2425	D8R2425, D16R2421, D8R2421, D16R2470
2426H	D8R2425	D16R2425, D8R2421, D16R2421, D16R2470
2426J	D16R2425	D8R2425, D16R2421, D8R2421, D16R2470
2427H	D8R2425	D16R2425, D8R2421, D16R2421, D16R2470
2427J	D16R2425	D8R2425, D16R2421, D8R2421, D16R2470
2460	D16R2460	D8R24521, D16R2421, D8R2425, D16R2425, D16R2470
2461	D16R2470	D8R2421, D16R2421, D8R2425, D16R2425
2470	D16R2470	D8R2421, D16R2421, D8R2425, D16R2425
375	D16R2440	D16R2441, D16R2445
2440	D16R2440	D16R2441, D16R2445
2441	D16R2441	D16R2440, D16R2445
2445J	D16R2445	D16R2441, D16R2440
2480	D16R2482	NONE
2482	D16R2482	NONE
2485J	D16R2482	NONE

NOTE:
When an alternate diaphragm is used, impedance, power handling, and frequency response are determined by diaphragm installed.

CONE KIT INTERCHANGEABILITY

The following magnet structures are mechanically compatible with each others' cone kits.

10" Frame
D110F, K110, E110, 2123H

12" Frame
D120F, D131, E120, K120, 121A/H, 124A, 2202A/B/H/J, 2203A/H

15" Frame
E130, (D130H), K130 (D130), K140 (E140), 136A/H, 2205A/B/C/H/J, 2225H/J, 2231A/H, 2234H, 2235H
2220A/B/C/H/J (130A/B/H) Has a unique voice coil gap and is not compatible with other models.
Alnico K145, LE15A/B, 2215A/B, 2216 are also unique and must be reconed separately from E145, LE15H and 2215H

18" Frame
E155-4, E155-8, 2240G/H, 2245H
E151-8 has a K151 frame and is not compatible with other models

Older Alnico pot structures may have been partially degaussed (discharged) and give a different response. E130 and E140 are 1 dB higher nominal flux than others (1.35 T verses 1.2 T) and will definitely yield a different response with other cone kits, typically 1 dB more midrange (piston band efficiency) and 1 dB less bass (low frequency damping). Any change is the customer's choice and liability.

SERVICE PROCEDURE - NARROW GAP TOP PLATES

Early production models of a few JBL transducers with Alnico magnet assemblies were manufactured with top plates that have a narrower gap size than is standard for that model of transducer. Consequently, current cone kits will not fit these units. All such units must be returned to the factory for modification in order to install a current cone kit. This page is designed to give you some assistance in determining whether the transducer in question has a normal or narrow gap top plate.

The only sure way to determine whether a transducer has a narrow gap is to cut out the cone assembly and measure the gap with a gauge (see Gap Gauge Chart). However, there are certain things to look for that may indicate a narrow gap. The first sign is if the top plate has turned a gold color (due to age and oxidation). Many old JBL speakers have gold top plates and most of them may be reconed with current kits. These include LE8's, LE10's, LE14's, LE15's, D120F's, 2215's and most D208's, D216's, D280's, and D123's. Current cone kit assemblies will fit these speakers.

The transducers that are most likely to have narrow gaps are D130's, D140's, D131's, D15S's, 150-4's, 130A's, and very old D208's, D216's, D280's, D123's, LE5-2's, and some very old 2205's and 2220's. When any of these units have a gold top plate, there is about a fifty percent chance that it will have a narrow gap.

Any speaker that has a two piece pot/magnet assembly made of rolled steel welded into a cylinder instead of a one piece cast iron assembly is very old and will have a narrow gap. Such transducers usually have a gold "James B. Lansing" signature style decal and a typed paper label instead of the newer metal foilcal. Another sign of old age is any cone transducer in which the gasket is made of real cork and not the cork/latex rubber composition that is currently used. Any transducer with a real cork gasket, notably the D208's, D216's, and D280's, may be considered suspect of having a narrow gap top plate. The older model D130's and D140's have large binding posts mounted directly on one of the frame rails, whereas the newer models have smaller binding posts (as used on our present hi-fi models) mounted on a separate plate next to the pot assembly. The older models are much more likely to have a narrow gap.

Older compression drivers may also be found to have narrow gap top plates and current diaphragms will not fit these units properly. These units must also be returned to the factory for modification.

In conclusion, there are no hard and fast rules as to which speakers will have narrow gaps. Happily, the number of these units is quite small; the vast majority of JBL transducers remain reconable as is, with current JBL kits.

GAP GAUGE USAGE GUIDE

.025	075(All), 076, 077, 2402/H, 2403/H, 2405/H
.029	LE25(All), LE20(All), LE26, 401-132
.031	LE85, LE175, 033, 034, 044, 066, 2410, 2420, 2421, 2425H/J, 2426H/J 2427H/J, 2460, 2461, 2470
.033	2415,
.036	375, 376, 2440, 2441, 2445J
.037	2416H
.038	A15G, A30G
.040	LE5(All), 2105, 2105H, T420, T425
.043	375AB, 375FH, 2480, 2482, T205
.044	D123, D208, D216, D280, 116A/H, 123A-1, 125A, 126A, 127A/H, 2110A/H 2212
.048	K110, LE8(All), LE10A, 123A-3, 2108A/H, 2115A/H, 2120, 2121/H, 2213/H 043109A/H
.051	LT-1
.053	122A, 112A/H, LE10H, LE111A/H
.057	E110, 128H-1, ALL LOW FREQUENCY TRANDUCERS WITH 4-INCH VOICE COILS, T540, T545, MI-SERIES

For Longest Gauge Life

1. Handle gauges only by aluminum handle.
2. When not in use, keep gauge pin coated with either a light machine oil or commercially available rust inhibitor.

RECONE/REDIAPHRAGM PROCEDURE

TOOLS AND SUPPLIES REQUIRED

Gap gauges, glue gun, glue, masking tape, soldering iron, solder, methyl ethyl ketone (MEK), cloth rags, plastic voice coil spacer tube(s), dome weights, tweezers, wire cutters, razor knife & blades, cotton swabs, phillips screwdriver, magnifying light, small mallet audio oscillator and amplifier, cardboard diggers (cut pieces of cardboard that are approximately 25 mm X 75 mm X 1 mm).

RECONING PROCEDURE

A. Preparation

1. Using razor knife, remove old cone/coil assembly and clean all surfaces where spider and compliance will mount of old glue.
2. Use gap gauge to check for proper size and alignment.
3. Check frame for tightness to magnet, cracks or warp.
4. Unsolder the old voice coil leads from terminals, and check the terminals for tightness and alignment.
5. Inspect new cone/coil assembly for shipping damage, etc.

B. Installation

1. Fold piece of masking tape lengthwise around cardboard "digger" with adhesive exposed. Insert in gap and rotate. Repeat until tape remains clean when withdrawn. Check gap with magnifying light. Clean top plate area of any debris.
2. Using glue gun, apply bead of glue on frame surfaces where spider and compliance will mount.
3. Fold voice coil spacer tube and insert inside new voice coil assembly, allowing overhang below bottom of voice coil. Slide spacer tube over pole piece and down into gap, making sure tinsel leads on assembly are aligned to terminals on frame. Carefully guide voice coil assembly down spacer onto frame and into proper position. Do not force.
4. Take a small rag dipped in MEK and use it to press down on spider where it joins to frame. Work back and forth to even out spider and secure bond to frame. Repeat for compliance, working out bumps.
5. Use tweezers to guide tinsel leads through solder lugs. Allow enough slack for full cone excursion, but do not allow leads to touch (short). Solder leads to terminals and trim excess.
6. Allow glue 24 hours to dry, and then carefully pull out voice coil spacer tube. Unit can be sound tested at this point.

C. Gasket Installation and Doming

1. Place gasket segments on frame to check for proper fit and alignment. Remove gasket pieces, and lay bead of glue on horizontal mounting surface. Install gasket.
2. To install dome, first use glue gun to place a bead of glue around cone collar. Be careful, too much glue may drip down inside of voice coil, and too little glue may cause a loose dome. Use glue gun to cover leads on cone face. Center dome onto cone. Apply another bead of glue at junction of cone and dome. Clean up excess glue with cotton swab and MEK. Place padded weight on top of the dome and allow to dry.
3. After glue is thoroughly dry, sound speaker with oscillator and amplifier.

REDIAPHRAGM PROCEDURE

A. Preparation

1. Check unit for damage (cracked throat, shifted top plate, etc.). Remove front cover and old diaphragm assembly. On ring radiators, remove inner cone and outer horns and unsolder old diaphragm.
2. Using gap gauge, check gap for size and alignment.
3. On 2-inch throat drivers, tap on top of phasing plug. The unit should make a solid sound. A "hollow" or "clicking" sound indicates a loose phasing plug.

B. Diaphragm Installation

1. Fold piece of masking tape lengthwise around a cardboard digger with adhesive side exposed. Insert in gap and rotate to clean out debris. Continue cleaning until tape is clean when withdrawn. Inspect visually with magnifying light.
2. Inspect new diaphragm for damage. Line up holes in diaphragm to mounting pins on the driver. Carefully lower assembly into place. Replace diaphragm mounting screws. On ring radiators, solder leads to terminals.
3. On drivers, hook unit up to oscillator set at 3-4 volts at proper frequency (550 Hz on 1-inch drivers, 350 Hz on 2-inch drivers). Listen for buzzing. Use small mallet to tap lightly on side of diaphragm frame until unit is centered in gap and buzzing ceases. Tighten down diaphragm mounting screws.
4. Reconnect terminal leads onto diaphragm assembly and replace cover. On ring radiators, replace inner and outer horn.
5. Perform final sound test.

C. Diaphragm Installation for Models 2425, 2426, 2427, and 2445*

1. Fold piece of masking tape lengthwise around a cardboard digger with adhesive side exposed. Insert in gap and rotate to clean out debris. Continue cleaning until tape is clean when withdrawn. Inspect visually with magnifying light. Inspect new diaphragm for defects or damage.
2. Remove cover gasket to expose JBL name that is stamped into the top plate. Using both hands, carefully position diaphragm mounting holes in alignment with top plate mounting holes, and in put terminal with polarity marking aligned with JBL name in top plate. Polarity marking for 8 ohms will be green, and for 16 ohms the marking will be red. **Warning: do not rotate the diaphragm while the voice coil is in the gap.** With mounting holes and polarity marking positioned correctly, carefully lower the diaphragm into top-plate recess. Be sure the base of the diaphragm mounting ring is positioned flush to the surface of the top-plate recess. Insert mounting screws and hand tighten.

*NOTE: Some 2445 top plates may be stamped with an 'X' in place of the JBL logo.

035TI DIAPHRAGM INSTALLATION PROCEDURE

1. Carefully remove diaphragm assembly from the packaging. Inspect the diaphragm/flange assembly for shipping damages; coil/diaphragm, flange, etc. Check the voice coil terminals for continuity.

2. Inspect voice coil gap assembly for proper alignment.

3. Clean voice coil assembly by following the steps outlined in the Rediaphragm Procedure B #1.

4. Align diaphragm/flange mounting holes with top plate mounting holes (qty 4) while aligning the flange top plate mounting pegs (qty 2) with the top plate pegs inserts *(qty 4). Lower the diaphragm assembly into place avoiding coil interference with the pole piece and dampening pad (sponge).

5. Hand tighten the mounting screws that are opposite of each.

6. Sound test @ 3 volts input sweeping from 200 Hz-1200 Hz frequency sweep test.

7. Install screen and retaining ring.

*The first few thousand 035TI units were manufactured with 4 top plate peg inserts. Recent 035TI's now have 2 peg inserts.

RECONING PROCEDURE FOR THE UREI 803C AND 801C CO-AX DRIVERS

1. Observe the mounting position of the dust dome/spider that is attached to the horn. You will need to remount a new dust dome/spider in this position, so it is helpful to establish a reference mounting position. There should actually be a small flange or raised area on the horn that the dust dome/spider is resting against

2. Unscrew the compression driver assembly from the back of the transducer. Once this is done you should be able to see two phillips head screws on either side of the horn throat.

3. Remove the two screws mentioned above. Use **CAUTION** because the horn is held in place by only these two screws.

4. Cut the horn loose from the rest of the cone assembly. (This step may also be done prior to step #3.)

5. Clean the horn careful. Strong solvents Methyl Ethyl Ketone (MEK can damage the plastic horn)

6. Clean the frame in the same manner as for any JBL repair.

7. Proceed to recone the speaker as per normal JBL procedure. See page

8. Mount the dust dome/spider to the horn first (See Step 1 above)

9. Reattach the horn to the transducer.

10. Use a white glue (or almost any other clear drying glue) and carefully secure the dust dome/spider to the cone. Some installers have found it helpful to use a syringe to apply the white glue.

11. Reattach the compression driver.

POLARITY CONVENTIONS OF JBL TRANSDUCERS AND SYSTEMS

A positive signal to the black terminal will result in a positive wave form from the transducer for the following transducers:

1. All JBL transducers which have color coded terminals
2. All 4300 Series monitor systems (except the 4311 and the 4312)
3. All 4400 Series monitor systems
4. All 4600 Series user assembled systems
5. 4660 system
6. 4671OK system (please note that the specification sheet for the 4671OK incorrectly identifies its polarity)
7. All JBL L Series consumer systems
8. 8330 surround system

A positive signal to the red terminal will result in a positive wave form from the transducer for the following transducers:

1. Cabaret Series systems (positive is tip of 6.3mm (1/4 inch) plug)
2. MI Series systems (positive is tip of 6.3mm (1/4 inch) plug)
3. 4612OK (Consistent with the 4612 Cabaret model)
4. SLT-1 miniature system
5. 4311 and 4312 monitor systems
6. 8316 foreground music system
7. 8325 surround system
8. JBL Series

For additional information on JBL polarity conventions please consult the JBL Technical Notes Volume 1, Number 12, titled "Polarity Conventions of JBL Transducers and Systems."

CONE TRANSDUCER TEST SPECIFICATIONS

MODEL	FRAME	DOME	MAGNET	NOML	DYNAMIC TEST		DC RESISTANCE	NOTES
	SIZE&COLOR		TYPE	IMP	INPUT V	SWEEP FREQ HZ	MINIMUM-MAXIMUM	
5A390	14"/Black	Paper	Alnico	8	8	30-1200	5.9-7.1	Aquaplas on the front and back of the cone
101	15"/Grey	Aluminum	Alnico	8	10	20-1200	5.8-6.8	
104H	5"/Black	Aluminum	Ferrite	8	4	75-3K	3.7-4.6	
108H	8"/Black	Paper	Ferrite	8	6	20-1200	4.8-5.8	
112A	8"/Black	Paper	Alnico	8	6	30-1200	5.5-6.7	
112H	8"/Black	Paper	Ferrite	8	6	30-1200	5.2-6.4	
115H	6"/Unpainted	Paper	Ferrite	8	4	30-1200	3.2-3.6	Aquaplas on cone
115H-1	6"/Black	Paper	Ferrite	8	4	30-1200	3.7-4.6	
116A	8"/Unpainted	Paper	Alnico	8	5	30-1200	5.0-5.4	Dome inverted
116H	8"/Unpainted	Paper	Ferrite	8	5	30-1200	4.8-5.6	Dome inverted
116H-2	8"/Unpainted	Paper	Ferrite	8	5	30-1200	4.8-5.6	
117H	8"/Unpainted	Paper	Ferrite	8	5	30-1200	5.0-6.0	Aquaplas on cone
117H-1	8"/Unpainted	Paper	Ferrite	8	5	30-1200	5.0-6.0	Aquaplas on cone
118H	10"/Unpainted	Paper	Ferrite	8	5	30-1200	5.1-6.1	Aquaplas on cone
121A	12"/Black	Paper	Alnico	8	10	20-1200	5.7-6.9	Mass ring
121H	12"/Black	Paper	Ferrite	8	10	20-1200	5.7-6.9	Mass ring
122A	12"/Black	Paper	Alnico	8	6	20-1200	4.5-5.5	Mass ring
122A-1	12"/Black	Paper	Alnico	8	6	20-1200	4.5-5.5	Aquaplas on the back of the cone
123A-1	12"/Black	Paper	Alnico	8	6	20-1200	4.5-5.5	Aquaplas on cone
123A-2	12"/Black	Paper	Alnico	8	6	20-1200	4.5-5.5	Aquaplas on cone, dome inverted
123A-3	12"/Black	Paper	Alnico	8	6	20-1200	4.5-5.5	Aquaplas on cone
123F	12"/Black	Aluminum	Alnico	8	6	20-1200	5.3-6.3	
124A	12"/Black	Paper	Alnico	8	10	20-1200	5.7-6.9	Mass ring

CONE TRANSDUCER TEST SPECIFICATIONS

MODEL	FRAME	DOME	MAGNET	NOML	DYNAMIC TEST		DC RESISTANCE	NOTES
	SIZE&COLOR		TYPE	IMP	INPUT V	SWEEP FREQ HZ	MINIMUM-MAXIMUM	
124H	12"/Black	Paper	Ferrite	8	10	20-1200	5.7-6.9	Mass ring
125A	10"/Unpainted	Paper	Alnico	8	5	30-1200	4.7-5.7	Dome inverted
126A	12"/Black	Paper	Alnico	8	6	20-1200	4.5-5.5	Mass ring
127A	10"/Unpainted	Paper	Alnico	8	5	30-1200	4.8-5.6	
127H	10"/Unpainted	Paper	Ferrite	8	5	30-1200	4.8-5.6	
127H-1	10"/Unpainted	Paper	Ferrite	8	5	30-1200	5.5-6.5	
128H	12"/Black	Paper	Ferrite	8	6	20-1200	5.1-6.3	Aquaplas on cone
128H-1	12"/Black	Paper	Ferrite	8	6	20-1200	5.1-6.3	Black Aquaplas on the front of the cone
129H	12"/Black	Paper	Ferrite	8	6	20-1200	5.1-6.3	Aquaplas on the back of the cone
130A	15"/Grey	Paper	Alnico	8	10	20-1200	5.2-6.2	
130AS	15"/Grey	Aluminum	Alnico	8	10	20-1200	5.2-6.2	
130B	15"/Grey	Paper	Alnico	16	14	20-1200	12.1-14.3	
130BP	15"/Grey	Paper	Alnico	16	14	20-1200	12.1-14.3	
130H	15"/Black	Paper	Ferrite	8	10	20-1200	5.2-6.2	
135A	15"/Black	Paper	Alnico	8	10	20-1200	5.7-6.9	Aquaplas on cone
136A	15"/Black	Paper	Alnico	8	10	20-1200	5.8-6.8	Mass ring
136H	15"/Black	Paper	Ferrite	8	10	20-1200	5.7-6.9	Mass ring
150-4	15"/Grey	Paper	Alnico	32	14	20-1200	18.0-20.0	
150-4C	15"/Grey	Paper	Alnico	16	14	20-1200	8.8-9.3	
150-H	15"/Grey	Paper	Alnico	16	14	20-1200	8.8-9.3	
305G	5"/Stamped	Aluminum	Ferrite	8	4	75-3K	3.9-4.4	
305G-1	5"/Stamped	Paper	Ferrite	8	4	75-3K	3.8-4.6	
305G-2	5"/Black	Paper	Ferrite	8	4	75-3K	3.8-4.6	

CONE TRANSDUCER TEST SPECIFICATIONS

MODEL	FRAME	DOME	MAGNET	NOMI.	DYNAMIC TEST		DC RESISTANCE	NOTES
	SIZE&COLOR		TYPE	IMP	INPUT V	SWEEP FREQ HZ	MINIMUM-MAXIMUM	
305G-3	5"/Black	Paper	Ferrite	8	4	75-3K	3.8-4.6	
306G-2	6"/Black	Paper	Ferrite	8	4	30-1200	4.6-5.8	
306G-3	6"/Black	Paper	Ferrite	8	4	30-1200	4.6-5.8	
308G	8"/Stamped	Aluminum	Ferrite	8	5	30-1200	4.8-5.8	
308G-1	8"/Stamped	Paper	Ferrite	8	5	30-1200	4.8-5.8	
308G-2	8"/Black	Paper	Ferrite	8	5	30-1200	4.8-5.9	
310G	10"/Unpainted	Aluminum	Ferrite	8	5	30-1200	4.0-4.8	
310G-1	10"/Unpainted	Paper	Ferrite	8	5	30-1200	3.6-4.5	
310G-2	10"/Black	Paper	Ferrite	8	5	30-1200	3.8-4.8	
310G-3	10"/Black	Paper	Ferrite	8	5	30-1200	3.8-4.8	
312G	12"/Stamped	Aluminum	Ferrite	8	5	30-1200	4.0-4.5	
312G-1	12"/Stamped	Paper	Ferrite	8	5	30-1200	3.8-4.6	
401-133	12"/Green	Paper	Alnico	8	6	20-1200	4.4-5.0	OEM Green Aquaplas
401-134	14"/Green	Paper	Alnico	8	8	30-1200	5.9-7.1	Green Aquaplas
2105	5"/Grey	Paper	Alnico	8	4	75-3K	5.6-6.8	Dome inverted
2105H	5"/Black	Aluminum	Ferrite	8	4	75-3K	5.1-6.3	Binding posts
2108	8"/Grey	Paper	Alnico	8	6	30-1200	5.5-6.7	
2108H	8"/Black	Paper	Ferrite	8	6	30-1200	5.2-6.4	
2110	8"/Grey	Aluminum	Alnico	8	4	30-1200	4.9-5.9	
2110H	8"/Black	Aluminum	Ferrite	8	4	30-1200	5.3-6.5	
2115A	8"/Grey	Aluminum	Alnico	8	4	20-1200	5.0-6.0	
2115B	8"/Grey	Aluminum	Alnico	16	4	20-1200	10.5-12.7	
2115H	8"/Black	Aluminum	Ferrite	8	4	20-1200	5.1-6.1	

CONE TRANSDUCER TEST SPECIFICATIONS

MODEL	FRAME	DOME	MAGNET	NOMI.	DYNAMIC TEST		DC RESISTANCE	NOTES
	SIZE&COLOR		TYPE	IMP	INPUT V	SWEEP FREQ HZ	MINIMUM-MAXIMUM	
2115J	8"/Black	Aluminum	Ferrite	16	4	20-1200	11.8-13.2	
2118H	8"/Black	Paper	Ferrite	8	6	20-1200	4.8-5.8	
2118J	8"/Black	Paper	Ferrite	16	10	20-1200	9.6-11.7	
2120	10"/Grey	Aluminum	Alnico	8	7	20-1200	5.5-6.5	
2121	10"/Grey	Paper	Alnico	8	7	30-1200	5.4-6.6	Dome inverted
2121H	10"/Grey	Paper	Ferrite	8	7	30-1200	6.2-7.4	Dome inverted
2122H	10"/Black	Paper	Ferrite	8	7	30-1200	5.2-6.4	
2123H	10"/Black	Paper	Ferrite	8	7	30-1200	5.6-6.4	
2125	12"/Grey	Aluminum	Alnico	8	6	20-1200	5.5-6.5	
2130	12"/Grey	Aluminum	Alnico	8	10	20-1200	5.5-6.5	
2135	15"/Black	Aluminum	Alnico	8	10	20-1200	5.8-6.8	
2202A	12"/Grey	Paper	Alnico	8	10	20-1200	5.1-5.9	
2202B	12"/Grey	Paper	Alnico	16	14	20-1200	12.2-14.4	
2202H	12"/Black	Paper	Ferrite	8	10	20-1200	5.2-6.2	
2202J	12"/Black	Paper	Ferrite	16	14	20-1200	9.6-11.6	
2203A	12"/Grey	Paper	Alnico	8	10	20-1200	5.7-6.9	Mass ring
2203H	12"/Grey	Paper	Ferrite	8	10	20-1200	5.7-6.9	Mass ring
2204H	12"/Black	Paper	Ferrite	8	10	20-1200	5.6-6.8	
2205A	15"/Grey	Paper	Alnico	8	10	20-1200	5.1-5.9	
2205B	15"/Grey	Paper	Alnico	16	14	20-1200	12.2-14.9	
2205C	15"/Grey	Paper	Alnico	32	14	20-1200	22.5-27.5	
2205H	15"/Black	Paper	Ferrite	8	10	20-1200	5.1-6.1	
2205J	15"/Black	Paper	Ferrite	16	14	20-1200	12.1-14.7	

CONE TRANSDUCER TEST SPECIFICATIONS

MODEL	FRAME	DOME	MAGNET	NOMI.	DYNAMIC TEST		DC RESISTANCE	NOTES
	SIZE&COLOR		TYPE	IMP	INPUT V	SWEEP FREQ HZ	MINIMUM-MAXIMUM	
2212	12"/Grey	Paper	Alnico	8	6	20-1200	4.4-5.0	Aquaplas on cone
2213	12"/Grey	Paper	Alnico	8	6	20-1200	4.5-5.5	Aquaplas on cone
2213H	12"/Black	Paper	Ferrite	8	6	20-1200	4.0-4.8	Aquaplas on cone
2214H	12"/Black	Paper	Ferrite	8	6	20-1200	5.1-6.3	
2215	15"/Grey	Paper	Alnico	8	10	20-1200	5.2-6.2	
2215A	15"/Grey	Paper	Alnico	8	10	20-1200	5.2-6.2	
2215B	15"/Grey	Paper	Alnico	16	14	20-1200	7.6-9.2	
2215H	15"/Black	Paper	Ferrite	8	10	20-1200	8.0-9.6	
2215J	15"/Black	Paper	Ferrite	16	14	20-1200	8.0-9.6	
2216	15"/Grey	Paper	Alnico	8	10	20-1200	5.1-5.9	
2220A	15"/Grey	Paper	Alnico	8	10	20-1200	5.2-6.2	
2220B	15"/Grey	Paper	Alnico	16	14	20-1200	11.7-14.3	
2220C	15"/Grey	Paper	Alnico	32	14	20-1200	23.0-27.0	
2220H	15"/Grey	Paper	Ferrite	8	10	20-1200	5.2-6.2	
2220J	15"/Grey	Paper	Ferrite	16	14	20-1200	12.0-14.6	
2225H	15"/Black	Paper	Ferrite	8	10	20-1200	5.6-6.7	
2225J	15"/Black	Paper	Ferrite	16	14	20-1200	11.5-14.2	
2230A	15"/Grey	Paper	Alnico	8	10	20-1200	5.7-6.9	
2230B	15"/Grey	Paper	Alnico	16	14	20-1200	12.1-14.4	Mass ring
2231A	15"/Grey	Paper	Alnico	8	10	20-1200	5.7-6.9	Mass ring
2231H	15"/Black	Paper	Ferrite	8	10	20-1200	5.7-6.9	Mass ring
2234H	15"/Black	Paper	Ferrite	8	10	20-1200	5.4-6.6	
2235H	15"/Black	Paper	Ferrite	8	10	20-1200	5.4-6.6	Mass ring

CONE TRANSDUCER TEST SPECIFICATIONS

MODEL	FRAME	DOME	MAGNET	NOMI.	DYNAMIC TEST		DC RESISTANCE	NOTES
	SIZE&COLOR		TYPE	IMP	INPUT V	SWEEP FREQ HZ	MINIMUM-MAXIMUM	
2240G	18"/Black	Paper	Ferrite	4	7	20-1200	2.1-2.6	
2240H	18"/Black	Paper	Ferrite	8	10	20-1200	5.9-6.5	
2245H	18"/Black	Paper	Ferrite	8	10	20-1200	5.0-6.0	Aquaplas on the back of the cone
023101	15"/Orange	Aluminum	Alnico	8	10	20-1200	5.7-6.9	Fender
023101A	15"/Orange	Aluminum	Alnico	8	10	20-1200	5.7-6.9	Fender
023101H	15"/Black	Aluminum	Ferrite	8	10	20-1200	5.7-6.9	Fender
023125A	12"/Orange	Aluminum	Alnico	16	14	20-1200	11.7-14.3	Fender
023125J	12"/Black	Aluminum	Ferrite	16	14	20-1200	11.7-14.3	Fender
043091	15"/Orange	Aluminum	Alnico	8	10	20-1200	5.2-6.2	Fender
043091A	15"/Orange	Aluminum	Alnico	8	10	20-1200	5.2-6.2	Fender
043091H	15"/Black	Aluminum	Ferrite	8	10	20-1200	5.2-6.2	Fender
043109A	10"/Orange	Aluminum	Alnico	8	7	20-1200	5.4-6.6	Fender
043109H	10"/Black	Aluminum	Ferrite	8	7	20-1200	5.5-6.6	Fender
092577A	12"/Orange	Aluminum	Alnico	8	10	20-1200	5.7-6.9	Fender
092577H	12"/Black	Aluminum	Ferrite	8	10	20-1200	5.7-6.9	Fender
970302A	15"/Orange	Aluminum	Alnico	16	14	20-1200	11.7-14.3	Fender
970401	15"/Orange	Aluminum	Alnico	8	10	20-1200	5.0-6.0	Fender
970401A	15"/Orange	Aluminum	Alnico	4	7	20-1200	3.0-3.6	Fender
970402	15"/Orange	Aluminum	Alnico	16	14	20-1200	11.9-14.5	Fender
970402A	15"/Orange	Aluminum	Alnico	16	14	20-1200	11.9-14.5	Fender
70777022	15"/Black	Aluminum	Alnico	4	7	20-1200	2.9-3.5	Peavey
AMPEX8	8"/Unpainted	Aluminum	Alnico	8	4	30-1200	4.9-5.9	Leads 180° apart, OEM
D15S	15"/Grey	Aluminum	Alnico	16	10	20-1200	10.7-12.3	

CONE TRANSDUCER TEST SPECIFICATIONS

MODEL	FRAME	DOME	MAGNET	NOMI.	DYNAMIC TEST		DC RESISTANCE	NOTES
	SIZE&COLOR		TYPE	IMP	INPUT V	SWEEP FREQ HZ	MINIMUM-MAXIMUM	
D110F	10"/Black	Aluminum	Alnico	8	7	20-1200	5.5-6.5	
D110F-2	10"/Black	Aluminum	Alnico	4	5	20-1200	3.0-3.4	
D110F-6	10"/Black	Aluminum	Alnico	16	1	020-120	011.0-13.0	
D120F	12"/Grey	Aluminum	Alnico	8	10	20-1200	5.8-6.8	
D120F-2	12"/Grey	Aluminum	Alnico	4	7	20-1200	3.0-3.4	
D120F-6	12"/Grey	Aluminum	Alnico	16	14	20-1200	11.0-13.0	
D123	12"/Grey	Aluminum	Alnico	8	8	20-3K	5.3-6.3	
D123-3	12"/Grey	Aluminum	Alnico	8	8	20-3K	5.3-6.3	
D123F	12"/Grey	Aluminum	Alnico	8	8	20-3K	5.3-6.3	
D124	12"/Grey	Paper	Alnico	8	10	20-1200	6.0-7.0	
D130	15"/Grey	Aluminum	Alnico	8	10	20-1200	5.8-6.8	
D130F	15"/Grey	Aluminum	Alnico	8	10	20-1200	5.8-6.8	
D130F-2	15"/Grey	Aluminum	Alnico	4	7	20-1200	3.0-3.4	
D130F-6	15"/Grey	Aluminum	Alnico	16	14	20-1200	11.9-14.1	
D130H	15"/Black	Aluminum	Ferrite	8	10	20-1200	5.7-6.9	
D131	12"/Grey	Aluminum	Alnico	8	10	20-1200	5.8-6.8	
D131F	12"/Grey	Aluminum	Alnico	8	10	20-1200	5.8-6.8	
D140F	15"/Grey	Aluminum	Alnico	8	10	20-1200	5.1-5.9	
D140F-2	15"/Grey	Aluminum	Alnico	4	7	20-1200	3.1-3.5	
D140F-6	15"/Grey	Aluminum	Alnico	16	14	20-1200	12.2-14.4	
D140R	15"/Grey	Paper	Alnico	8	10	20-1200	5.1-5.9	OEM
D140R-2	15"/Grey	Paper	Alnico	4	7	20-1200	3.3-3.8	OEM
D140R-18	15"/Grey	Paper	Alnico	16	14	20-1200	12.2-14.9	OEM

CONE TRANSDUCER TEST SPECIFICATIONS

MODEL	FRAME	DOME	MAGNET	NOMI.	DYNAMIC TEST		DC RESISTANCE	NOTES
	SIZE&COLOR		TYPE	IMP	INPUT V	SWEEP FREQ HZ	MINIMUM-MAXIMUM	
D204	8"/Grey	Aluminum	Alnico	4	4	30-1200	2.9-3.5	
D208	8"/Grey	Aluminum	Alnico	8	4	30-1200	4.9-5.9	Binding posts reversed
D208H	8"/Black	Aluminum	Ferrite	8	4	30-1200	5.3-6.5	Binding posts reversed
D216	8"/Grey	Aluminum	Alnico	16	4	30-1200	10.5-12.6	
D260	8"/Grey	Aluminum	Alnico	8	4	30-1200	4.9-5.9	Leads 180° apart
D280	8"/Grey	Aluminum	Alnico	8	4	30-1200	5.4-6.3	Aquaplas on cone
E110-8	10"/Black	Aluminum	Ferrite	8	7	20-1200	5.5-6.6	
E110-16	10"/Black	Aluminum	Ferrite	16	10	20-1200	11.9-14.5	
E120-8	12"/Black	Aluminum	Ferrite	8	10	20-1200	5.7-6.9	
E120-16	12"/Black	Aluminum	Ferrite	16	14	20-1200	11.7-14.3	
E130-4	15"/Black	Aluminum	Ferrite	4	7	20-1200	2.9-3.5	
E130-8	15"/Black	Aluminum	Ferrite	8	10	20-1200	5.6-6.9	
E130-16	15"/Black	Aluminum	Ferrite	16	14	20-1200	11.7-14.3	
E140-8	15"/Black	Aluminum	Ferrite	8	10	20-1200	5.2-6.2	
E140-16	15"/Black	Aluminum	Ferrite	16	14	20-1200	11.9-14.5	
E145-8	15"/Black	Paper	Ferrite	8	10	20-1200	5.2-6.2	
E145-16	15"/Black	Paper	Ferrite	16	14	20-1200	12.1-14.7	
E151	18"/Black	Paper	Ferrite	8	10	20-1200	5.4-6.6	K151 style frame
E155-4	18"/Black	Aluminum	Ferrite	8	10	20-1200	2.3-2.8	
E155-8	18"/Black	Aluminum	Ferrite	8	10	20-1200	5.4-6.6	
G125-8	10"/Black	Paper	Ferrite	8	10	20-1200	-----	
G135-8	12"/Black	Paper	Ferrite	8	10	20-1200	-----	
K110	10"/Black	Aluminum	Alnico	8	7	20-1200	5.4-6.6	

CONE TRANSDUCER TEST SPECIFICATIONS

MODEL	FRAME	DOME	MAGNET	NOML	DYNAMIC TEST		DC RESISTANCE	NOTES
	SIZE&COLOR		TYPE	IMP	INPUT V	SWEEP FREQ HZ	MINIMUM-MAXIMUM	
K110-4	10"/Black	Aluminum	Alnico	4	5	20-1200	2.9-3.5	
K110-16	10"/Black	Aluminum	Alnico	16	10	20-1200	12.0-14.5	
K120	12"/Black	Aluminum	Alnico	8	10	20-1200	5.7-6.9	
K120-4	12"/Black	Aluminum	Alnico	4	7	20-1200	3.1-3.9	
K120-16	12"/Black	Aluminum	Alnico	16	14	20-1200	10.8-13.2	
K130	15"/Black	Aluminum	Alnico	8	10	20-1200	5.7-6.9	
K130-4	15"/Black	Aluminum	Alnico	4	7	20-1200	2.9-3.5	
K130-16	15"/Black	Aluminum	Alnico	16	14	20-1200	11.3-13.8	
K140	15"/Black	Aluminum	Alnico	8	10	20-1200	5.0-6.0	
K140-4	15"/Black	Aluminum	Alnico	4	7	20-1200	3.0-3.6	
K140-16	15"/Black	Aluminum	Alnico	16	14	20-1200	12.2-14.9	
K145	15"/Black	Paper	Alnico	8	10	20-1200	8.5-8.8	
K145-4	15"/Black	Paper	Alnico	4	7	20-1200	3.0-3.6	
K145-16	15"/Black	Paper	Alnico	16	14	20-1200	12.1-14.7	
K151	18"/Black	Paper	Alnico	8	10	20-1200	5.4-6.6	
K151-4	18"/Black	Paper	Alnico	4	7	20-1200	2.3-2.7	
K151-16	18"/Black	Paper	Alnico	16	14	20-1200	12.0-14.2	
LE5-2	5"/Black	Paper	Alnico	8	4	75-3K	5.5-6.5	Dome inverted
LE5-3	5"/Black	Paper	Alnico	8	4	75-3K	5.6-6.6	Dome inverted
LE5-4	5"/Black	Paper	Alnico	8	4	75-3K	5.6-6.6	Dome inverted
LE5-5	5"/Black	Paper	Ferrite	8	4	75-3K	5.6-6.6	
LE5-6	5"/Black	Aluminum	Ferrite	8	4	75-3K	5.6-6.8	
LE5-8	5"/Black	Aluminum	Ferrite	8	4	75-3K	5.6-6.8	

CONE TRANSDUCER TEST SPECIFICATIONS

MODEL	FRAME	DOME	MAGNET	NOML	DYNAMIC TEST		DC RESISTANCE	NOTES
	SIZE&COLOR		TYPE	IMP	INPUT V	SWEEP FREQ HZ	MINIMUM-MAXIMUM	
LE5-9	5"/Black	Aluminum	Ferrite	8	4	75-3K	5.1-6.3	
LE5-10	5"/Black	Aluminum	Ferrite	8	4	75-3K	4.9-6.1	
LE5-11	5"/Black	Aluminum	Ferrite	8	4	78-3K	4.9-6.1	
LE5-12	5"/Black	Aluminum	Ferrite	8	4	75-3K	4.9-6.1	
LE5H	5"/Black	Aluminum	Ferrite	8	4	75-3K	5.1-6.3	Binding posts
LE8	8"/Black	Aluminum	Alnico	8	4	20-1200	5.1-5.9	Aquaplas on cone, early models have no Aquaplas
LE8T	8"/Black	Aluminum	Alnico	8	4	20-1200	5.1-5.9	Aquaplas on cone
LE8T-2	8"/Black	Aluminum	Alnico	8	4	20-1200	5.1-5.9	No Aquaplas
LE8T-X	8"/Black	Aluminum	Alnico	16	4	20-1200	11.0-13.0	No Aquaplas
LE8TH	8"/Black	Aluminum	Ferrite	8	4	20-1200	5.0-6.0	Aquaplas on cone
LE10	10"/Black	Paper	Alnico	8	6	20-1200	4.4-5.0	Aquaplas on cone, dome inverted
LE10A	10"/Black	Paper	Alnico	8	6	20-1200	4.4-5.0	Aquaplas on cone, dome inverted
LE10A-1	10"/Unpainted	Paper	Alnico	8	6	20-1200	4.4-5.0	Aquaplas on cone, dome inverted
LE10H	10"/Black	Paper	Ferrite	8	6	20-1200	4.3-5.2	Aquaplas on the back of the cone
LE10H-1	10"/Black	Paper	Ferrite	8	6	20-1200	4.3-5.2	Aquaplas on cone
LE14A	14"/Black	Paper	Alnico	8	8	30-1200	5.9-7.1	Aquaplas on the front and back of the cone
LE14H	14"/Black	Paper	Ferrite	8	8	30-1200	5.7-6.9	Aquaplas on the front and back of the cone
LE14H-1	14"/Black	Paper	Ferrite	8	8	30-1200	5.7-6.9	Aquaplas on the front and back of the cone
LE15	15"/Grey	Paper	Alnico	16	10	20-1200	7.6-9.2	
LE15A	15"/Grey	Paper	Alnico	16	10	20-1200	7.6-9.2	
LE15B	15"/Grey	Paper	Alnico	8	8	20-1200	3.1-3.9	
LE15H	15"/Black	Paper	Ferrite	8	10	20-1200	8.0-9.6	
LE111A	10"/Black	Paper	Alnico	8	6	20-1200	5.5-6.5	Aquaplas on the back of the cone

CONE TRANSDUCER TEST SPECIFICATIONS

MODEL	FRAME	DOME	MAGNET	NOMI.	DYNAMIC TEST		DC RESISTANCE	NOTES
	SIZE&COLOR		TYPE	IMP	INPUT V	SWEEP FREQ HZ	MINIMUM-MAXIMUM	
LE111H	10"/Black	Paper	Ferrite	8	6	20-1200	4.3-5.2	Aquaplas on the back of the cone
M21	12"/Grey	Aluminum	Alnico	8	10	20-1200	5.7-6.9	OEM
M21-4	12"/Grey	Aluminum	Alnico	4	7	20-1200	3.1-3.9	OEM
M21-16	12"/Grey	Aluminum	Alnico	16	14	20-1200	10.8-13.2	OEM
M30	15"/Grey	Aluminum	Alnico	8	10	20-1200	5.7-6.9	OEM
M31	15"/Grey	Aluminum	Alnico	8	10	20-1200	5.7-6.9	OEM
M31-4	15"/Grey	Aluminum	Alnico	4	7	20-1200	2.9-3.5	OEM
M31-16	15"/Grey	Aluminum	Alnico	16	14	20-1200	11.3-13.8	OEM
M32	15"/Grey	Aluminum	Ferrite	8	10	20-1200	5.7-6.9	OEM
M32-4	15"/Grey	Aluminum	Ferrite	4	7	20-1200	2.9-3.5	OEM
M32-16	15"/Grey	Aluminum	Ferrite	16	14	20-1200	11.3-13.8	OEM
M35-4	15"/Grey	Aluminum	Alnico	4	7	20-1200	2.9-3.5	OEM
M41	15"/Grey	Aluminum	Alnico	8	10	20-1200	5.0-6.0	OEM
M41-4	15"/Grey	Aluminum	Alnico	4	7	20-1200	3.0-3.6	OEM
M41-16	15"/Grey	Aluminum	Alnico	16	14	20-1200	12.2-14.9	OEM
M42-8	15"/Grey	Aluminum	Ferrite	8	10	20-1200	5.7-6.9	OEM
M42-16	15"/Grey	Aluminum	Ferrite	16	14	20-1200	12.2-14.9	OEM
M45	15"/Grey	Paper	Alnico	8	10	20-1200	8.5-8.8	OEM
M45-4	15"/Grey	Paper	Alnico	4	7	20-1200	3.0-3.6	OEM
M45-16	15"/Grey	Paper	Alnico	16	14	20-1200	12.1-14.7	OEM
M46-8	15"/Grey	Paper	Ferrite	8	10	20-1200	8.5-8.8	OEM
M46-16	15"/Grey	Paper	Ferrite	16	14	20-1200	12.1-14.7	OEM
M51	18"/Grey	Paper	Alnico	8	10	20-1200	5.4-6.6	OEM

CONE TRANSDUCER TEST SPECIFICATIONS

MODEL	FRAME	DOME	MAGNET	NOMI.	DYNAMIC TEST		DC RESISTANCE	NOTES
	SIZE&COLOR		TYPE	IMP	INPUT V	SWEEP FREQ HZ	MINIMUM-MAXIMUM	
M51-4	18"/Grey	Paper	Alnico	4	7	20-1200	2.3-2.7	OEM
M51-16	18"/Grey	Paper	Alnico	16	14	20-1200	12.0-14.2	OEM
M55	18"/Grey	Aluminum	Ferrite	8	10	20-1200	5.4-6.6	OEM
MI	10"/Black	Aluminum	Alnico	8	7	20-1200	5.4-6.6	OEM
MI-10	10"/Black	Paper	Ferrite	8	10	20-1200	5.1-6.1	
MI-12	12"/Black	Paper	Ferrite	8	10	20-1200	5.1-6.1	
MI-12-1	12"/Black	Paper	Ferrite	8	10	20-1200	5.1-6.1	With grille
MI-15	15"/Black	Paper	Ferrite	8	10	20-1200	5.1-6.1	
MI1-4	10"/Black	Aluminum	Alnico	4	5	20-1200	2.9-5.3	OEM
MI1-16	10"/Black	Aluminum	Alnico	16	10	20-1200	12.0-14.5	OEM

CO-AXIALTRANSDUCER TEST SPECIFICATIONS

MODEL	FRAME	DOME	MAGNET	NOM	DYNAMIC TEST		DC RESISTANCE	NOTES
		SIZE&COLOR	TYPE	IMP SL	INPUT V	SWEEP FREQ HZ	MINIMUM-MAXIMUM	
LE12C	12"/Black		Alnico	8				Network attached to frame
Low freq					6	20-1200	4.5-5.5	Aquaplas on cone
High freq.		Paper			6	1K-3K	3.7-4.2	High frequency has screen
LE14C	14"/Black		Alnico	8				2 sets of terminals
Low freq.					8	30-1200	6.7-8.3	Aquaplas on the front and back of the cone
High freq		Paper			3	1K-3K	3.7-4.2	High frequency has screen
2145	12"/Grey	---	Alnico	8				Network attached to frame
Low freq.					6	20-1200	4.5-5.5	Aquaplas on cone
High freq.		Paper			6	1K-3K	3.7-4.2	High frequency has screen
2150	15"/Grey	---	Alnico	8				2 sets of terminals
Low freq					10	20-1200	5.1-5.9	
High freq.	5"/Grey	Paper			4	75-3K	5.6-6.5	Dome inverted
5A395	14"/Grey		Alnico	8				OEM, 2 sets of terminals
Low freq					8	30-1200	6.7-8.3	Aquaplas on the front and back of the cone
High freq		Paper			3	1K-3K	3.7-4.2	High frequency has screen
5A415	15"/Grey		Alnico	8				OEM, 2 sets of terminals
Low freq					10	20-1200	5.1-5.9	
High freq	5"/Grey	Paper			4	75-3K	5.6-6.5	Dome inverted

HIGH FREQUENCY TRANSDUCER TEST SPECIFICATIONS

MODEL	TYPE OR	DIAPHRAGM	MAGNET	NOM	DYNAMIC TEST		DC RESISTANCE	NOTES
	THROAT SIZE	MATERIAL	TYPE	IMP SL	INPUT V	SWEEP FREQ HZ	MINIMUM-MAXIMUM	
010	1" Dome	Cloth	Ferrite	4	3	2K-12K	2.4-2.9	
011	1" Dome	Cloth	Ferrite	4	3	2K-12K	2.7-3.0	
024	1" Dome	Phenolic	Ferrite	8	5	200-1200	35-4.5	
033	1" Dome	Phenolic	Ferrite	8	5*	200-1200	3.6-4.4	*Test with network
034	1" Dome	Phenolic	Ferrite	8	2.5*	200-1200	5.4-6.6	*Test with network
035TI	1" Dome	Titanium	Ferrite	8	2.5*	2K-12K	3.7-4.5	*Test with network
044	1" Dome	Phenolic	Ferrite	8	2*	2K-12K	5.1-6.6	*Test with network
044-1	1" Dome	Phenolic	Ferrite	8	2	2K-12K	5.4-6.6	Gold dome, black flange
044Ti	1" Dome	Titanium	Ferrite	8	1	*2K-12K	3.7-4.6	*Test with network
044Ti-1	1" Dome	Titanium	Ferrite	8	1*	2K-12K	3.7-4.6	*Test with network
066	1" Dome	Phenolic	Ferrite	8	5	*200-1200	3.5-4.4	*Test with network
LE20	1 3/4" Cone	Paper	Alnico	8	6*	1K-6K	3.7-4.2	*Test with network with dust screen
LE20-1	1 3/4" Cone	Paper	Alnico	8	6*	1K-6K	3.7-4.2	*Test with network
LE21H	1 3/4" Cone	Paper	Ferrite	8	3	500-1200	3.7-4.2	Has binding posts
LE25	1 3/4" Cone	Paper	Ferrite	8	3	500-1200	3.7-4.2	
LE25-1	1 3/4" Cone	Paper	Ferrite	8	3	500-1200	3.7-4.2	
LE25-2	1 3/4" Cone	Paper	Ferrite	8	3	500-1200	3.6-4.4	
LE25-3	1 3/4" Cone	Paper	Ferrite	8	3	500-1200	3.7-4.2	
LE25-4	1 3/4" Cone	Paper	Ferrite	8	3	500-1200	3.7-4.2	
LE25-5	1 3/4" Cone	Paper	Ferrite	8	3	500-1200	3.7-4.2	
LE261	3/4" Cone	Paper	Ferrite	8	3	500-1200	3.4-4.3	Plastic flange
LE30	3" Dome	Aluminum	Alnico	8	3	350-1200	5.4-6.6	
401-132	1 3/4" Cone	Paper	Alnico	8	6*	1K-3K	3.7-4.2	*Test with network, OEM
303G	2" Cone	Plastic	Ferrite	8	4*	1K-2K	3.6-4.4	*Test with network
303G-1	2" Cone	Paper	Ferrite	8	4*	1K-2K	3.6-4.4	*Test with network

HIGH FREQUENCY TRANSDUCER TEST SPECIFICATIONS

MODEL	TYPE OR	DIAPHRAGM	MAGNET	NOM	DYNAMIC TEST		DC RESISTANCE	NOTES
	THROAT SIZE	MATERIAL	TYPE	IMP SL	INPUT V	SWEEP FREQ HZ	MINIMUM-MAXIMUM	
303G-2	2" Cone	Paper	Ferrite	8	4*	1K-2K	3.6-4.4	*Test with network
075	Integral horn	Aluminum	Alnico	8	7*	1K-3K	5.7-6.7	*Test with network
075R	Integral horn	Aluminum	Alnico	8	7*	1K-3K	5.7-6.7	*Test with network, OEM
075-022	Integral horn	Aluminum	Alnico	8	7*	1K-3K	5.7-6.7	*Test with network, motion detector
075-105	Integral horn	Aluminum	Alnico	8	7*	1K-3K	5.7-6.7	*Motion detector
075-105B	Integral horn	Aluminum	Alnico	8	7*	1K-3K	5.7-6.7	*Motion detector
075-105C	Integral horn	Aluminum	Alnico	8	7*	1K-3K	5.7-6.7	*Motion detector
075-105CH	Integral horn	Aluminum	Alnico	8	7*	1K-3K	5.7-6.7	*Motion detector
075-105D	Integral horn	Aluminum	Alnico	8	7*	1K-3K	5.7-6.7	*Motion detector
076	Integral horn	Aluminum	Alnico	16	7*	1K-3K	5.7-6.7	*Test with network
077	Integral horn	Aluminum	Alnico	16	7*	1K-3K	5.7-6.7	*Test with network
LE75	1"	Aluminum	Alnico	16	3.5	550-1200	5.9-7.0	
LE85	1"	Aluminum	Alnico	16	3.5	550-1200	5.9-7.0	
LE100S	1"	Phenolic	Alnico	16	3.5	350-1200	5.0-6.0	
LE175	1"	Aluminum	Alnico	16	3.5	550-1200	5.9-7.0	
LE175-200	1"	Aluminum	Alnico	16	3.5	550-1200	5.9-7.0	
LE175DLH	1"	Aluminum	Alnico	16	3.5	550-1200	5.9-7.0	
LE175HP	1"	Phenolic	Alnico	16	3.5	350-1200	5.9-7.0	
D175	1"	Aluminum	Alnico	16	3.5	550-1200	5.9-7.0	
175	1"	Aluminum	Alnico	16	3.5	550-1200	5.9-7.0	
275	1"	Aluminum	Alnico	16	3.5	550-1200	5.5-7.0	
375	2"	Aluminum	Alnico	16	3.5	350-1200	7.3-8.6	
375H	2"	Aluminum	Alnico	16	3.5	350-1200	7.3-8.6	
375AB	2"	Phenolic	Alnico	16	5	350-1200	5.8-6.9	No phasing plug
375EX	2"	Phenolic	Alnico	16	5	350-1200	5.8-6.9	No phasing plug

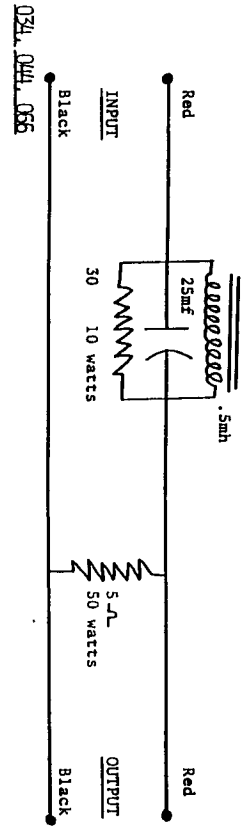
HIGH FREQUENCY TRANSDUCER TEST SPECIFICATIONS

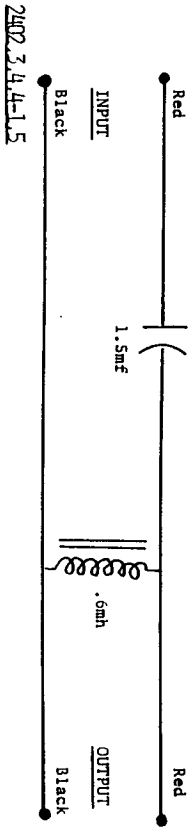
MODEL	TYPE OR	DIAPHRAGM	MAGNET	NOM	DYNAMIC TEST		DC RESISTANCE	NOTES
	THROAT SIZE	MATERIAL	TYPE	IMP SL	INPUT V	SWEEP FREQ HZ	MINIMUM-MAXIMUM	
375FH	2"	Phenolic	Alnico	16	5	350-1200	5.8-6.9	No phasing plug
375HP	2"	Phenolic	Alnico	16	5	350-1200	5.8-6.9	
376	2"	Aluminum	Alnico	16	3.	5350-1200	7.3-8.6	
2402	Integral horn	Aluminum	Alnico	8	7*	1K-3K	5.7-6.7	*Test with network
2402H	Integral horn	Aluminum	Ferrite	8	7*	1K-3K	5.7-6.7	*Test with network
2403	Integral horn	Aluminum	Alnico	16	7*	1K-3K	5.7-6.7	*Test with network
2403H	Integral horn	Aluminum	Ferrite	16	7*	1K-3K	5.7-6.7	*Test with network
2404H	Integral horn	Aluminum	Ferrite	16	7*	1K-3K	5.7-6.7	*Test with network
2404H-1	Integral horn	Aluminum	Ferrite	8	7*	1K-3K	5.7-6.7	*Test with network
2405	Integral horn	Aluminum	Alnico	16	7*	1K-3K	5.7-6.7	*Test with network
2405H	Integral horn	Aluminum	Ferrite	16	7*	1K-3K	5.7-6.7	*Test with network
2410	1"	Aluminum	Alnico	16	3.5	550-1200	5.9-7.0	
2415	1"	Titanium	Ferrite	8	3	550-1200	3.5-4.3	Screw on mounting
2416	1"	Titanium	Ferrite	8	2.85	550-1200	2.9-3.5	Screw on mounting
2420	1"	Aluminum	Alnico	16	3.5	550-1200	5.9-7.0	
2421A	1"	Aluminum	Alnico	8	2.85	550-1200	2.9-3.5	
2421B	1"	Aluminum	Alnico	16	3.5	550-1200	5.9-7.0	
2425H	1"	Titanium	Ferrite	8	2.85	550-1200	2.9-3.5	
2425J	1"	Titanium	Ferrite	16	3.5	550-1200	5.9-7.0	
2426H	1"	Titanium	Ferrite	8	2.85	550-1200	2.9-3.5	Screw on/bolt on mounting
2426J	1"	Titanium	Ferrite	16	3.5	550-1200	5.9-7.0	Screw on/bolt on mounting
2427H	2"	Titanium	Ferrite	8	2.85	550-1200	2.9-3.5	Screw on/bolt on mounting
2427J	2"	Titanium	Ferrite	16	3.5	550-1200	5.9-7.0	Screw on/bolt on mounting
2440	2"	Aluminum	Alnico	16	3.5	350-1200	7.3-8.6	
2441	2"	Aluminum	Alnico	16	3.5	350-1200	7.3-8.6	

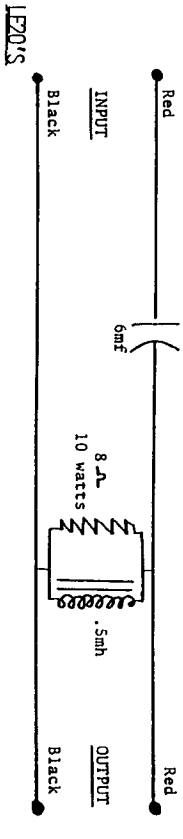
HIGH FREQUENCY TRANSDUCER TEST SPECIFICATIONS

MODEL	TYPE OR	DIAPHRAGM	MAGNET	NOM	DYNAMIC TEST		DC RESISTANCE	NOTES
	THROAT SIZE	MATERIAL	TYPE	IMP SL	INPUT V	SWEEP FREQ HZ	MINIMUM-MAXIMUM	
2445J	2"	Titanium	Ferrite	16	3.5	350–1200	7.3–8.6	
2460	1"	Phenolic	Alnico	16	3.5	350–1200	6.0–7.0	
2461	1"	Phenolic	Alnico	16	5	350–1200	10.1–11.8	
2470	1"	Phenolic	Alnico	16	5	350–1200	10.1–11.8	
2475	1"	Phenolic	Alnico	16	5	350–1200	10.1–11.8	
2480	2"	Phenolic	Alnico	16	3.5	350–1200	5.8–6.9	
2482	2"	Phenolic	Alnico	16	5	350–1200	8.6–10.2	
2485J	2"	Phenolic	Ferrite	16	5	350–1200	8.6–10.2	
HL180	1"	Phenolic	Alnico	16	5	350–1200	10.1–11.8	
5A350	1"	Aluminum	Alnico	16	3.5	550–1200	5.9–7.0	OEM
5P350	1"	Phenolic	Alnico	16	3.5	350–1200	6.0–7.0	OEM
5A355	1"	Aluminum	Alnico	16	3.5	550–1200	5.7–7.0	OEM
5P355	1"	Phenolic	Alnico	16	5	350–1200	10.1–11.8	OEM
5A360	2"	Aluminum	Alnico	16	3.5	350–1200	7.3–8.6	OEM
5P360	2"	Phenolic	Alnico	16	5	350–1200	5.8–6.9	OEM
MI11419	1"	Aluminum	Alnico	16	3.5	550–1200	5.9–7.0	OEM
MI11426	2"	Phenolic	Alnico	16	5	350–1200	8.7–10.2	OEM
MI11426A	2"	Phenolic	Alnico	16	5	350–1200	8.7–10.2	OEM
MI11427	2"	Aluminum	Alnico	16	3.5	350–1200	7.3–8.6	OEM

HIGH FREQUENCY TEST NETWORK SCHEMATICS







Technical Manual

120Ti

SPECIFICATIONS

ACOUSTIC & ELECTRICAL SPECIFICATIONS:

- Rated Impedance: 8 ohms
- Power Range: (Max) 250 Watts
- Frequency Response: 35-27 kHz
- Sensitivity: 89 dB*
- Crossover Frequencies: 900 Hz, 4 kHz

SYSTEM COMPONENTS:

- Cabinet: C120Ti
- Grille: G120Ti
- Low Frequency: 128H-1, 12" Aquaplas Laminate

SYSTEM COMPONENTS: *(cont'd)*

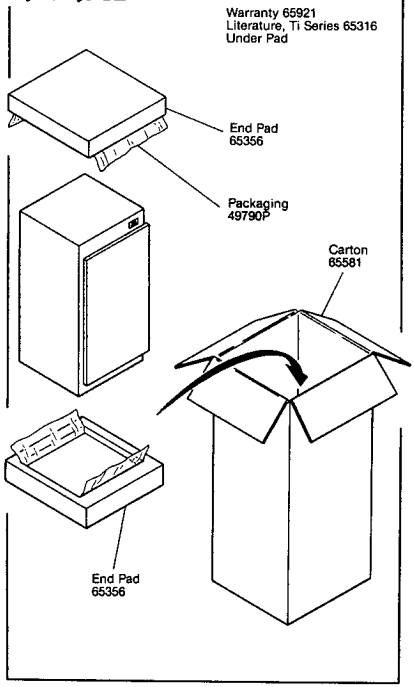
- Mid Range Frequency: 104H, 5" Filled Polypropylene
- High Frequency: 044Ti, 1" Titanium Dome
- Crossover Network: N120Ti, 3 Way

PHYSICAL SPECIFICATIONS:

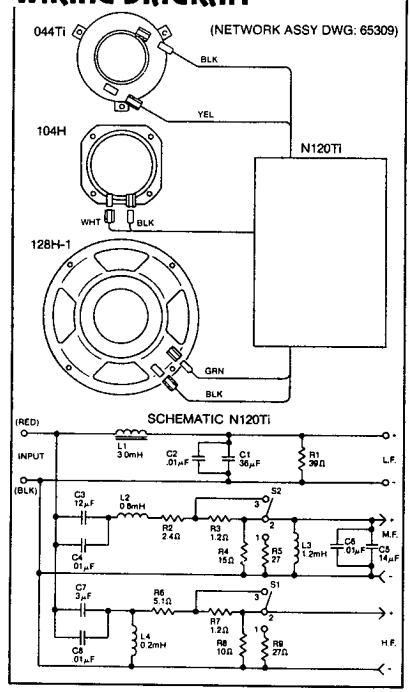
- Enclosure Dimensions: 24.5 x 14.25 x 11.0 (Inch)
- Shipping Weight: 56 lbs.

*SPL, 2.83V @ 1m

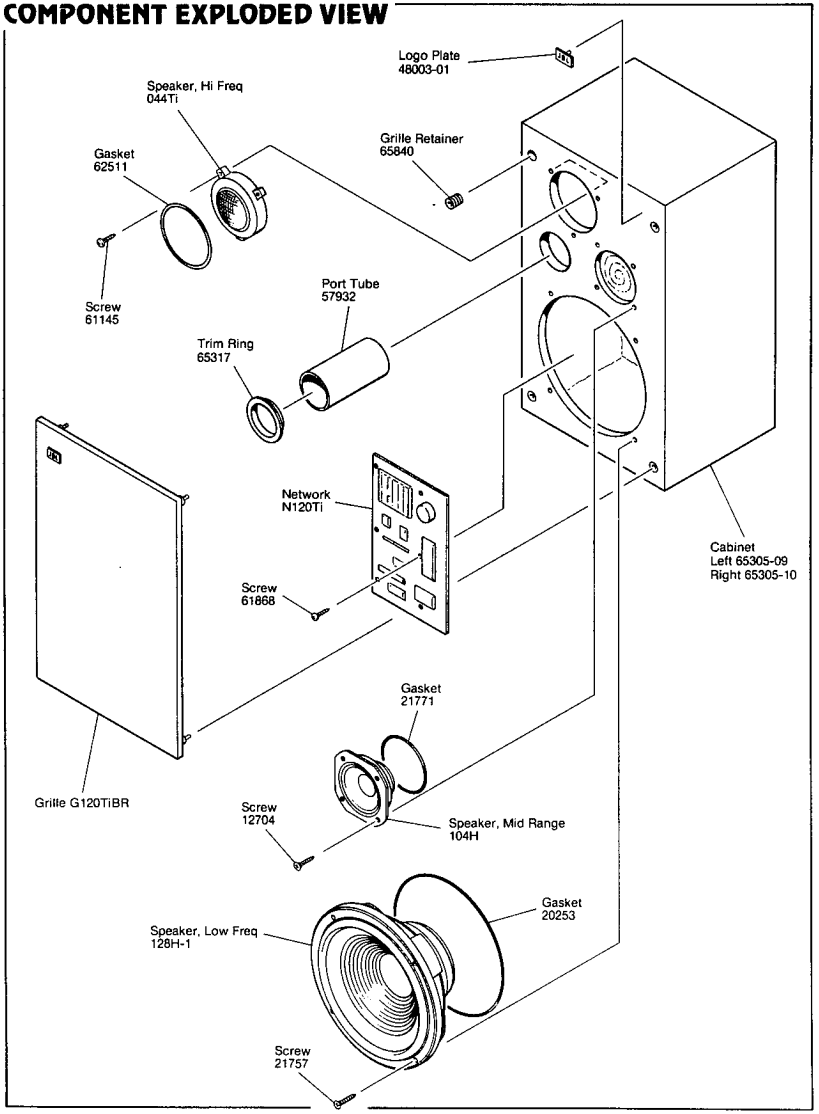
PACKAGE



WIRING DIAGRAM



COMPONENT EXPLODED VIEW



Technical Manual

18Ti

SPECIFICATIONS

ACOUSTIC & ELECTRICAL SPECIFICATIONS:

- Rated Impedance: 8 ohms
- Power Range: (Max) 200 Watts
- Frequency Response: 45-27 kHz
- Sensitivity: 88 dB*
- Crossover Frequencies: 3 kHz

SYSTEM COMPONENTS:

- Cabinet: C18Ti
- Grille: G18Ti
- Low Frequency: 115H-1, 6½" Filled Polypropylene

SYSTEM COMPONENTS: *(cont'd)*

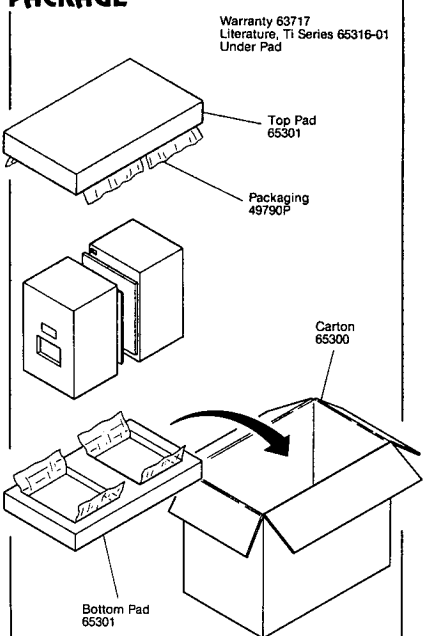
- High Frequency: 044Ti, 1" Titanium Dome
- Crossover Network: N18Ti, 2 Way

PHYSICAL SPECIFICATIONS:

- Enclosure Dimensions: 14.75 x 9.375 x 7.187 (Inch)
- Shipping Weight: 17½ lbs.

*SPL, 2.83V @ 1m

PACKAGE



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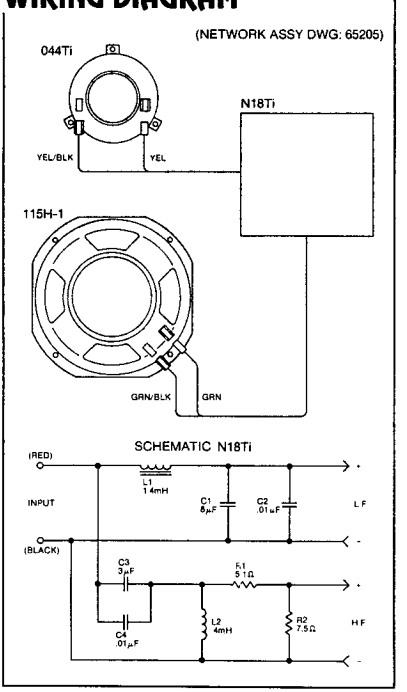
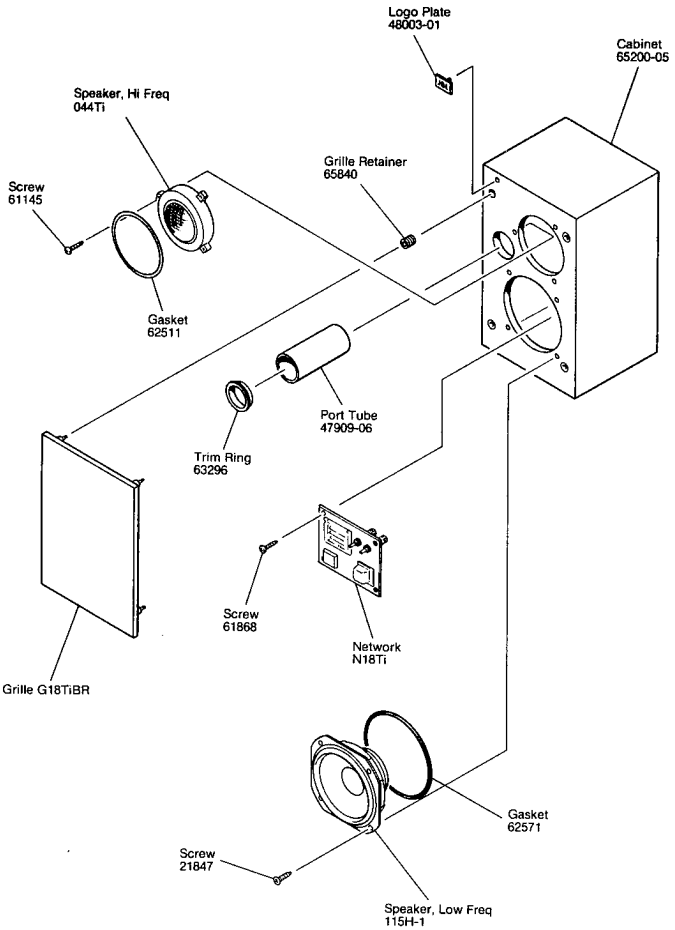


18Ti REV A

COMPONENT EXPLODED VIEW



Technical Manual

240Ti

SPECIFICATIONS

ACOUSTIC & ELECTRICAL SPECIFICATIONS:

- Rated Impedance: 8 ohms
- Power Range: (Max) 300 Watts Per Channel
- Frequency Response: 30-27 kHz
- Sensitivity: 89 dB*
- Crossover Frequencies: 900 Hz, 4 kHz

SYSTEM COMPONENTS:

- Cabinet: C240Ti
- Grille: G240Ti
- Low Frequency: LE14H-1, 14" Aquaplas Laminate

SYSTEM COMPONENTS: *(cont'd)*

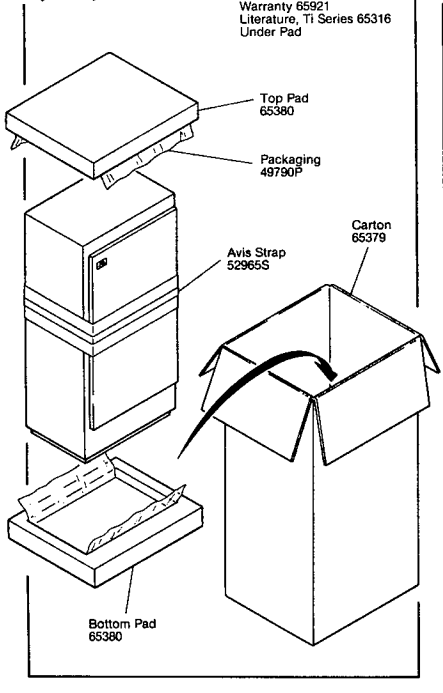
- Mid Range Frequency: 104H, 5" Filled Polypropylene
- High Frequency: 044Ti, 1" Titanium Dome
- Crossover Network: N240Ti, 3 Way

PHYSICAL SPECIFICATIONS:

- Enclosure Dimensions: 36.625 x 18.0 x 12.0 (Inch)
- Shipping Weight: 85 lbs.

*SPL, 2.83V @ 1m

PACKAGE



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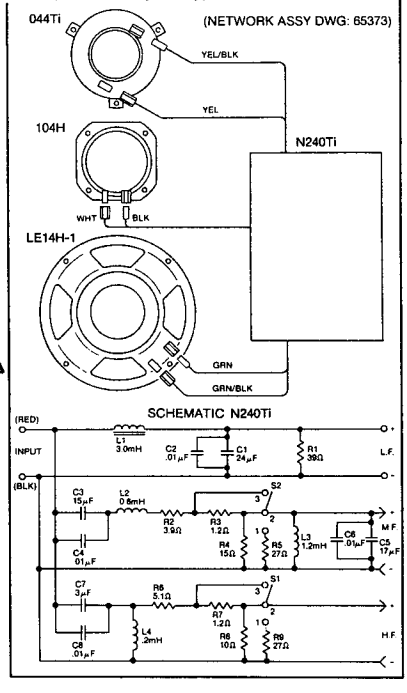

240Ti REV A