

INSTRUCTION BOOK FOR LUBELL LL916 UNDERWATER SPEAKER



**LUBELL LABS INC.
21 NORTH STANWOOD ROAD
COLUMBUS, OHIO 43209 U.S.A.
(614) 235-6740**

LL916 UNDERWATER SPEAKER & AC205 TRANSFORMER BOX

The Lubell Labs Model LL916 underwater speaker with AC205 inline audio isolation transformer box was designed to meet the need for a quality, high output underwater speaker selling at a reasonable price. Its patented broadband high-output design easily fills large pools with pleasing, wide range sound. It is as effective for synchronized swimming as it is for communicating with divers and dolphins in the open ocean.

The LL916 integrates features from LL Model I and LL Model II prototypes. The piston closure of the Model I provides ruggedness at a reasonable cost, while the improved acoustic design of the Model II enhances the quality and quantity of available sound.

The ribbed casting, flanged piston design of the speaker makes possible the attainment of low-Q in a small size underwater radiator, while the integral compliance element presents an optimum load to the driving element.

The shell of the LL916 serves the dual function of piston radiator and water tight enclosure for driving element and electronics. Electrical variations are changed to force variations using the piezoelectric effect. The force variations move the two pistons in unison against the reaction of radiation resistance and mass. Because of the high impedance of aqueous media, small excursions of the pistons produce acoustic waves of considerable strength.

The speaker is clad in a rugged 30 mil blue PVC coating with redundant seals, and is EPDM shock mounted in a PVC coated stainless steel cage. A 25' heavy duty cord is hardwired to the speaker and is either terminated with a molded Conxall Multi-Con-X 3182-3PG-524 connector (LL916C3) or supplied with bare end for contractor termination (LL916C). Coding: White (+); Black (-); Green (ground).

For portable applications, the LL916C3 is provided with the model AC205C audio isolation transformer box, which has mating Multi-Con-X 4182-3SG-300 output connector and screw terminal input. Order stock number LL916C-T1.

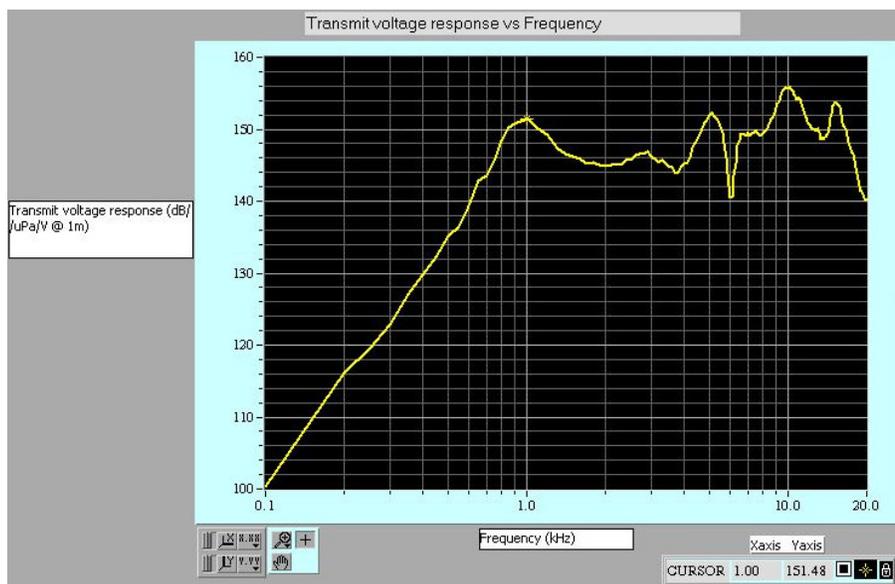
For semi-portable contractor installation, the LL916C3 U/W speaker is provided with the model AC205B audio transformer box (screw terminal I/O) and the OP1 all-weather jack plate (4182-3SG-300 on pigtail). Order stock number LL916C-T3. The OP1 plate is installed on a single-gang J-box on a wall or post by the pool, and conduit/cable is run from this J-box to the AC205B and amp in the indoor control room. Amplifier selection and connection is discussed in the installation and operation section of this guide.

SPECIFICATIONS: Lubell LL916 U/W Speaker

Frequency Response:	200Hz - 20kHz
Maximum Speaker Cable Voltage:	20-volts rms
Directivity:	Omni-directional 200Hz-2kHz Slight scalloping 2kHz-20kHz
Output Level:	180db/uPa/m @ 1kHz
Speaker Operating Depth:	5' minimum - 50' maximum
Dimensions:	
Speaker:	9.0" diameter x 5.50" axial length
Cage:	10.750"H x 10.750"W x 7.750"D
Net Weight:	14 lbs.
Shipping Weight:	17 lbs.

SPECIFICATIONS: AC205B/C

Frequency Response:	50Hz - 20kHz
Impedance (nominal):	16 ohms (with LL916 connected)
Input voltage:	25 Vrms line (or 75 watts @ 8 ohms)
Output Voltage:	20 Vrms
Connectors:	AC205B: Screw terminal in/out AC205C: Screw terminal in, 4182-3SG-300 out
Dimensions:	5.0"L x 3.5"W x 2.25"H
Net Weight:	2.25 lbs.
Shipping Weight:	3.0 lbs.



INSTALLATION & OPERATION

The Lubell Labs model LL916 underwater speaker is a precision instrument that deserves careful handling. The following simple rules will serve as a guide to achieving maximum life:

1. **CAUTION! Carefully inspect the underwater speaker cable before each use, and do not use if damaged. Do not attempt to open and self-repair the LL916 as this will void the warranty. If speaker cable needs replacement, please return the unit to us for low cost replacement. Please contact your installing dealer for questions regarding service, or call Lubell customer service at (614) 235-6740 between 8:30-17:00est.**
2. **CAUTION! Always vacate the water during electrical storms or inclement weather.**
3. **CAUTION! Be sure that your amplifier is connected to a GFCI protected AC outlet only, and is installed indoors on a shelf or in a vented equipment rack in an area with low humidity. If the amplifier will be used portably, it must be kept on a stationary wooden equipment table indoors with a minimum distance of 10' away from the water.**
4. A UL813 listed commercial sound amplifier must be selected that provides a 25V constant voltage speaker output. Allow 37.5 watts power consumption for each LL916/AC205 connected to the 25V line. We recommend Peavey UMA752 mixer/amp or IPA752 power amp (75 watts) to power one or two LL916/AC205's; Peavey UMA1502 mixer/amp or IPA1502 power amp (150 watts) for three or four LL916/AC205's; Peavey IPA300T for five to eight LL916/AC205's.
5. Connect AC205B/C transformer box(es) in parallel and in phase to the "25V" speaker output terminals on amp. AC205B box(es) must be located indoors, and may be located by the amplifier, or located closer to the OP1 jack plate(s) providing lower loss for long cable runs. Do not use L-pad or autoformer between the underwater speaker(s) and the amplifier. If remote volume control is needed, use the "remote volume" pot connection on the Peavey UMA series mixer, or insert a Crestron type volume controller between the source device (receiver, pre-amp, CD/tape) and the Peavey UMA amplifier's stereo tape/aux input.
6. The OP1 connector plate fastens to a single-gang all-weather J-box, which should be mounted at least 8" above the deck to a cabana wall or wooden post by the pool. For single speaker installations, center the J-box on the length of the pool where the U/W speaker will be placed; Run 1/2" conduit from this box back to the house. For two speaker installations, mount each J-box on a post 1/4 pool length from each end of the pool and run 1/2" conduit between J-boxes, and 1/2" conduit from one box back to house. Install 14 gauge 2 conductor speaker wire in the conduit between each transformer box and OP1 jack plate. Connect one end (of each pair) to "LL916" terminals (B=black, W=white) on AC205B transformer box and other end to OP1 connector plate's black and white wires. Connect the green ground wire from each OP1 connector to a good ground using #8 copper.
7. Take good care of the U/W speaker cable, as it is not covered under the guarantee. Do not use the speaker cable to lift, lower, or support the underwater speaker. Instead attach a sturdy 1/4" nylon cord to the speaker cage for this purpose. Lower the speaker to a 6' (1.83 meter)

depth, or place on the bottom of the pool. Experiment with position/rotation of speaker until best pool coverage is obtained.

8. Remove the underwater speaker(s) from the water after each use, and store in dry cabinet. Do not leave the speakers in the water, as automatic pool cleaner will damage the cable. Avoid scraping the speaker, as damage to the coating will result in eventual failure. If speaker is stored for prolonged periods, a white film (plasticizer) may appear on the speaker or cage. This is normal -- film may be washed off using a sponge and warm soapy water.

SYSTEM APPLICATION

These remarkable sets are a decade ahead of their time. Many engineers and scientists working in the field of underwater acoustics are still unaware of the feasibility of compressing the size of a low-frequency transducer without reducing its efficiency; or of the feasibility of driving a piezoelectric transducer over broad-band frequencies using common transistor amplifier circuitry. A partial list of current uses follows:

Swimming & Scuba Instruction

Gunlap and false start signal, competitive swimming

Recall of scuba divers to excursion boat or habitat

Paging of scuba divers & swimmers at popular resorts

NASA training facilities

Military and scientific research

Interrogation of suspicious divers by law enforcement

Communication during filming of movies with underwater scenes

Coordinating underwater work parties

Coordinating underwater explorations

Coordinating underwater treasure hunts

Training of killer whales, dolphins, and other species

Repelling/attracting Beluga whales, sharks, dolphins, manatees, and other species, away from atomic test sites, hydroelectric facilities, fishing nets, oil/chemical spills, intercoastal waterways, and other potentially dangerous situations.

OBTAINING SERVICE

No user serviceable parts are contained in the LL916 underwater speaker, AC205 transformer box, or the Peavey UMA or IPA series amplifiers.

Should your speaker or transformer box require service, please contact your installing dealer or call Lubell Labs at (614) 235-6740 between 8:30-17:00est for return instructions. If the Peavey amplifier requires service, please contact Peavey AA-repairs at (601) 483-5376 for a return authorization number and return instructions.

Please include a packing list (itemize contents), description of problem, your return address, and phone numbers to reach you at. Most repairs can be performed within 2 weeks. You will be contacted with an estimate prior to repair unless specified otherwise.

LIMITED WARRANTY

Lubell Labs warrants the LL916 and the AC205 to be free from defects in material and workmanship, under normal use and service, for a period of five years from the date of delivery to the first user-purchaser.

During this warranty period, the obligation of Lubell Labs is limited to repairing or replacing, as Lubell Labs may elect, any part or parts of such product which after examination by Lubell Labs discloses to be defective in material and/or workmanship.

Lubell Labs will provide warranty for any unit which is delivered, transported prepaid, to the Lubell Labs factory for examination and such examination reveals a defect in material and/or workmanship.

This warranty does not cover travel expenses, the cost of specialized equipment for gaining access to the product, or labor charges for removal and re-installation of the product. Not covered under the warranty: speaker burn-out, cord or connector damage, coating damage and subsequent speaker corrosion.

This warranty does not extend to any unit which has been subjected to abuse, misuse, improper installation, or which has been inadequately maintained; nor to units which have problems relating to service or modification at any facility other than the Lubell Labs Factory.

THERE ARE NO OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL LUBELL LABS BE LIABLE FOR ANY LOSS OF PROFITS OR ANY INDIRECT OR CONSEQUENTIAL DAMAGES ARISING OUT OF ANY SUCH DEFECT IN MATERIAL OR WORKMANSHIP.