

Instruction Guide for LL916 Underwater Speaker with AC203E Circuit Master



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LL916 UNDERWATER SPEAKER & AC203E TRANSFORMER BOX

The Lubell Labs Model LL916C3 underwater speaker with AC203E inline audio isolation transformer box (Circuit Master) 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 LL916C3 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 LL916C3 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 (50' optional) is hardwired to the speaker and is fitted with a molded Conxall Multi-Con-X 3182-3PG-524 3-pin connector.

For portable air and underwater sound applications such as the BASIC SYSTEM, the LL916C3 underwater speaker is provided with the model AC203E Circuit Master transformer box and an Inter-M A120 amplifier fitted with an isolated 1/4" jack with internal connection to the 25V (5.2 ohm) output. The AC203E input jack (labeled **AMPLIFIER**) must connect to this 25V output using the included Rapco RP16-2K speaker cord. The amplifier power cord must connect to a GFCI protected AC outlet in a dry area only. The transformer box has an **8 OHM AIR SPEAKER** jack (1/4" mono) for connecting the optional weatherproof Quadra 10 air speaker. The transformer box also has an **UNDERWATER SPEAKER** jack (3-pin) for connecting a Lubell LL916 or LL9816 underwater speaker. The AC203E **AIR VOLUME** control allows fine tuning of the air speaker sound level *after* the underwater sound level has been set at the amplifier. (Tip: during practice and meets, use the **MASTER** volume control on the A120 amplifier only to set the overall air & underwater speaker level as the source material recording levels change.)

SPECIFICATIONS: LL916C3

Frequency Range200Hz-20kHz
Maximum Cable Voltage 20-volts rms
Directivity Omnidirectional 200Hz-2kHz
 slight scalloping 2000Hz-20kHz
Output Level 180dB/uPa/m @ 900Hz with 20V rms applied
Required Operating Depth 5' minimum, 50' maximum
Dimensions:
LL916 Speaker9.280" OD x 5.630" axial length
Cage(HWD)10.750" x 10.750" x 7.750"
Net Weight 14.0 lbs.
Shipping Weight 17.0 lbs.

SPECIFICATIONS: AC203E

Frequency Range 100Hz - 20kHz
Impedance (minimum)8 ohms (with UW & 8 ohm air speaker connected)
Maximum Input Voltage. 25V rms
Recommended Amplifier. Inter-M A120 - 120W, 25V (5.2) ohm tap only
Connectors. Input: 1/4" mono phone jack
 U/W Speaker Output: 3-pin Conxall 4182-3SG-300
 Air Speaker Output: 1/4" mono phone jack (8 ohms min)
Size5.5"L x 4.7"W x 2.5"H
Shipping Weight 3.0 lbs.

OPERATION & MAINTENANCE

The Lubell Labs model LL916C3 underwater speaker and AC203E transformer box are precision instruments that deserves careful handling. The following simple rules will serve as a guide to achieving maximum performance and safety:

WARNING!: Always vacate the pool during inclement weather and lightning storms. Inspect all speaker and power cables before each use - do not use if damaged. Connect AC powered equipment to grounded GFCI outlet only. Keep AC powered equipment on a wooden equipment table at least 10' back from the water in a dry location only. Wear dry rubber soled shoes when setting up and operating equipment. Avoid excessive sound levels and/or microphone feedback squeal, which is harmful to hearing and equipment. Read and understand A120 amplifier manual and National Electric Code "Pool Audio Equipment" guidelines before using equipment.

1. Set up a wooden equipment table on the deck, a minimum distance of 10' away from the pool at the deep end. Place the Inter-M A120 amplifier on the table, and connect the Lubell AC203E Circuit Master to the amplifier's **SPEAKER OUTPUT** on the rear panel using included Rapco RP16 cord.
2. Place the optional Quadra 10 air speaker on the deck or optional SS7761B tripod at least 16' away from the pool, facing **away** from the announcer at the equipment table to prevent microphone feedback. Aim the air speaker diagonally across the water towards the bleachers to provide sound to the pool surface, deck, and bleacher area. Connect the air speaker to the Lubell AC203E **AIR SPEAKER** jack using the optional 25' H14-25LN2 Rapco speaker cable. Allow sufficient slack in this cable, and route it neatly to prevent people from stepping on or tripping over the cord.
3. Attach a thin all-weather rope of sufficient length to the Lubell LL916C3 underwater speaker cage. Lower the UW speaker to a 6' - 12' depth in the corner of the deep end; Tether in position or place on bottom. (Be extremely careful to keep the UW speaker connector dry during this step, and not to scrape the cable or cage on rough surfaces.) Connect the UW speaker cable to the Lubell AC203E UW **SPEAKER** jack. Allow sufficient slack in this cable, route neatly across deck and cover with a cord protector or rubber mat to prevent trips and damage.
4. Connect the optional TEAC AD500 or TASCAM C-DA500 CD/cassette deck (LINE OUT jacks) to the AUX1 stereo input (only!) on the Inter-M amplifier using included stereo patch cord. The second patch cord included with deck is a spare. (The AUX2 input is low sensitivity for pro equipment only.)
5. Connect optional ST95MK2 microphone to the MIC1, MIC2, or MIC3 input. (MIC1 jack has "ducking" control allowing music to auto mute to varying degrees while talking into the microphone.) Turn microphone body switch to OFF position until needed (see step 8 for instructions).
6. Now that all equipment is connected, pre-set controls as follows: mp3 volume control to 5 (bass boost off); Amplifier AUX1 volume control to 7; Amplifier BASS & TREBLE controls to

midway (0) position; Amplifier **MASTER** volume control to 0; AC203E Circuit Master **AIR LEVEL** control to 5.

7. To set sound levels in this step, you will need three lap or synchronized swimmers in the following locations: under the water, head above water, and in the bleachers. First turn the amplifier **MASTER** volume to 0 so no one gets blasted! Connect the Inter-M A120 amplifier's power cord and the TEAC AD500 CD/cassette deck's power cord into a *tested* GFCI protected wall socket. Turn on the CD/cassette deck power switch then the amplifier power switch. Insert a tape or CD into the TEAC CD/cassette and advance the music to a known section of music that is very loud. Slowly turn up the Inter-M A120 amplifier's **MASTER** volume control until the submerged swimmer indicates (with pre-arranged thumb up or down signal) that the UW sound level is correct and undistorted OR the power meter on the amplifier indicates all green with only an occasional flash of the red. Now turn the AC203E **AIR LEVEL** control up or down until the above-water swimmer *and* the person in the bleacher agree on an optimum sound level. The **AIR LEVEL** control on the AC203E Circuit Master is now optimized, and must not be touched again during the practice or competition. During the competition, you will need to keep your fingers on the Inter-M amplifier's **MASTER** volume control only to maintain sufficient sound level (using power meter on amplifier for a reference) as different CD's or tapes are played.

When switching sources of music from CD, cassette, or MP3, the recording levels and quality will vary all over the place. Using the air speaker as a monitor and your finely tuned ears (and amplifier power meter) to guide you, use the amplifier's **MASTER** volume control to maintain a consistent sound level. You may also use the amplifier's **BASS** and **TREBLE** controls *sparingly* (maybe +/- 2 increments from center position) to compensate for poor recordings). Always return **BASS** and **TREBLE** control to neutral center position when inserting the next team's tape or CD. DO NOT allow the amplifier's red clip light (on the watt meter bar) to light up solid -- if this happens, back down the amplifier **MASTER** volume control until the light is out or just flashing during loud peaks. **TIP:** If you hear distortion in the air speaker, then the swimmers will also hear this distortion in the underwater speaker -- turn down the amplifier's **AUX1** volume control (and the **MASTER** volume control if required) until the distortion is no longer audible.

8. Always use the microphone *behind* the air speaker to minimize feedback squeal. First switch **ON** the microphone using the switch on the microphone. Hold microphone against lips, speak in a normal voice, and turn the amplifier **MIC1** volume control up until the desired voice sound level is reached. Do not allow microphone squeal -- this is harmful to the swimmers, audience, and the loudspeakers. **TIP:** If you want the music to decrease while you talk into the microphone (connected to **MIC1** input), then use **MIC1 MUTE** control on the back of the amplifier to accomplish this. The amount of music muting can range from very little to complete muting.
9. After using equipment, tear down in reverse order. Inspect all cables for damage. Towel dry the UW speaker, and carefully coil the speaker cable inside the cage recess or around the speaker cage. Do not allow the cable to kink. Store all equipment in a dry, air conditioned equipment room only or else the corrosive pool atmosphere will damage the equipment and the connectors. **TIP:** To prevent loose "static" connections, periodically apply a light film of WD40 oil (using a Q-tip) to all cable end pins (mic, CD, speaker), then plug and unplug the connectors several times to distribute the oil evenly over the connectors.

SYSTEM APPLICATION

These remarkable systems are state-of-the-art. 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 ability to power a piezoelectric transducer over broad-band frequencies using common transistor amplifier circuitry. Only the patented Lubell underwater speaker can offer these qualities.

Some current applications:

Swimming & Scuba Instruction

Synchronized swimming instruction and competition

Gunlap signal, competitive swimming

False start signal, competitive swimming

Recall of scuba divers to excursion boat or habitat

Paging of scuba divers & swimmers at popular resorts

NASA & military training facilities

Military and scientific research

Interrogation of suspicious or illegal divers by military

Making underwater movies

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 hydroelectric facilities, fishing nets, oil/chemical spills, intercoastal waterways, and other potentially dangerous situations.

Dispelling aquatic creatures prior to setting off underwater explosion

OBTAINING SERVICE

No user serviceable parts are contained in the Lubell LL916C3 underwater speaker, Lubell AC203E Circuit Master, Inter-M A120 amplifier, TEAC AD500 CD/cassette, or Quadra 10 air speaker. Use a CD cleaning disc and cassette cleaner/demagnetizer cartridge every 10 hours to keep the AD500 deck in tip-top condition.

Should any of these items require service, please repackage securely in original shipping carton, and contact the manufacturer for a return authorization number (RA) and shipping instructions:

Inter-M: 866-636-5795

Lubell Labs: 614-235-6740

Peavey: 601-483-5376

TEAC: 323-727-7627

Please include a packing list (itemize contents), copy of sales receipt, description of problem, your return address, and phone numbers to reach you at. Most repairs can be performed within 1-2 weeks. You will be contacted with an estimate prior to repair unless a maximum repair amount was approved in advance.

LIMITED WARRANTY

Lubell Labs warrants the LL916C3 and the AC203E to be free from defects in material and workmanship, under non-commercial use, for a period of five years from the date of delivery to the first user-purchaser. Please refer to Inter-M, Peavey, and TEAC manuals for warranty information on these items, and return to appropriate manufacturer for service.

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 Lubell underwater speaker or transformer box 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 from abuse, coating damage on speaker or cage.

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.