UT195

HAND-HELD TRANSMITTER

OPERATING INSTRUCTIONS
and trouble-shooting guide

LECTROSONICS, INC.

Rio Rancho, NM

INTRODUCTION

Thank you for selecting the Lectrosonics T195 hand-held wireless transmitter. The T195 combines over 80 years of engineering experience with the very latest components in a design that addresses the most demanding professional applications.

The design of the T195 was the direct result of numerous conversations with users, staging and touring companies and dealers across the US. The specific concerns and needs brought up in these conversations led directly to the development of the operational features offered on the T195. This is certainly not the first hand-held transmitter ever designed, but it is definitely the most thoroughly engineered unit available.

The T195 is an integral microphone/transmitter with an internal antenna. The antenna is a dipole type utilizing the two printed circuit boards as the elements. The housing is composed of durable PVC, machined to a natural, comfortable shape. Internal mechanical parts are machined aluminum.

Only the T195 and UT195 transmitters are covered in this manual. Companion receivers are covered in separate manuals. The T195 will operate with any 195 Series Lectrosonics receiver on the same frequency.

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WARRANTY ..... Back cover

The T195 wireless microphone is FCC type accepted under the following parts:
Part 74 (174-216 MHz) and Part 74 (470-608 MHz)

T195 / UT195 Emission Designator: 180KF3E

GENERAL TECHNICAL DESCRIPTION

The T195 / UT195 transmitter is comprised of a number of functional sub-systems as shown in the block diagram below.

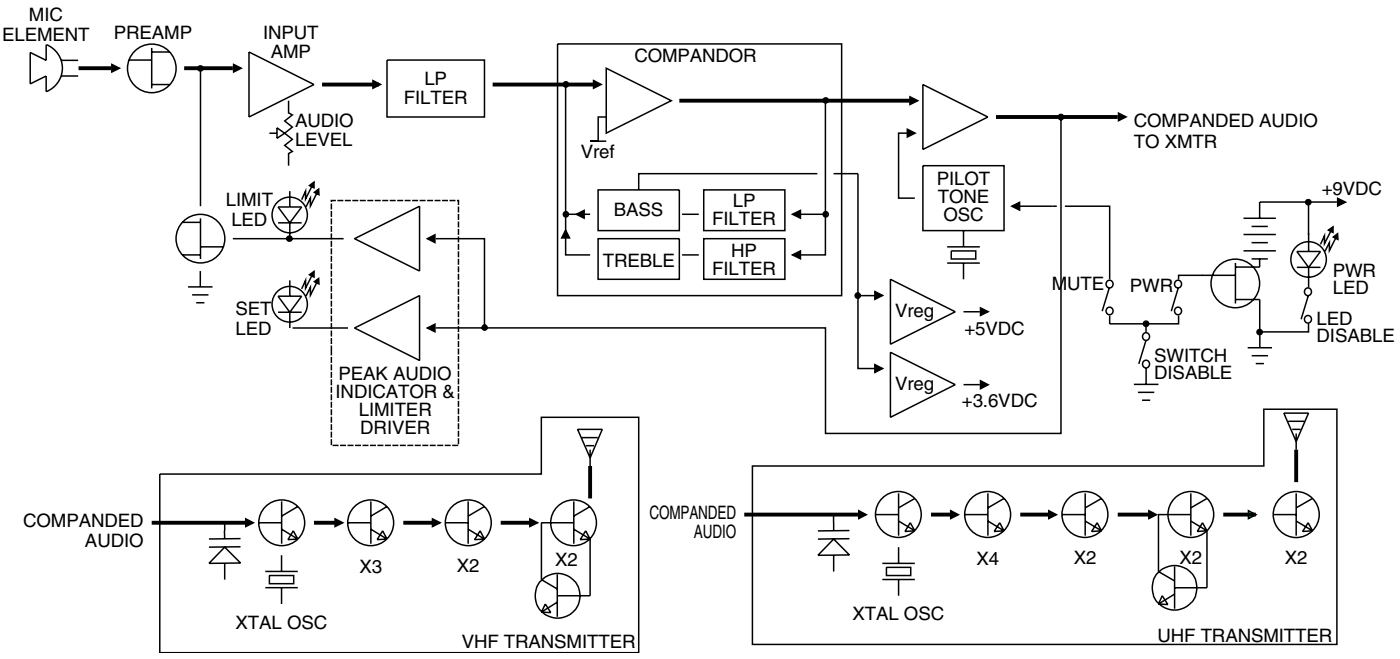
The T195 and UT195 utilize 75kHz deviation for compatibility with the 195 series receivers. The transmitter circuits are all regulated to allow full output power from the beginning (9 Volts) to the end (7 Volts) of battery life. The oscillator crystal is shock mounted to provide ruggedness. The input amplifier uses a Motorola 33079 op amp for ultra low noise operation and is gain controlled with a wide range input compressor which cleanly limits signal peaks up to 30dB above maximum modulation.

Compandors have long been a source of audible distortion in wireless microphone systems. The basic problem is that when the full bandwidth of the audio signal is processed by a single compandor, the attack and decay times will always be a compromise. If the time constants are fast, high frequency distortion will be low, however, faster time constants in the compandor create distortion of lower frequencies. If the time constants are slower, low frequency audio distortion will be low, but high frequency transients will then be distorted. The 195 system introduces an entirely new approach to solving this basic problem, called “dual-band companding.”

There are actually two separate compandors in the 195 system, one for high frequencies and one for low frequencies. A crossover network separates the frequency bands at 1kHz with a 6dB per octave slope, followed by separate high and low frequency compandors. The attack and release times in the high frequency compandor are fast enough to keep high frequency distortion at an extremely low level. The low frequency compandor uses slower time constants, reducing low frequency distortion to well below that of a conventional compandor.

The signal to noise ratio of the 195 system is high enough to preclude the need for conventional pre-emphasis (HF boost) in the transmitter and de-emphasis (HF roll off) in the receiver. Pre-emphasis and de-emphasis in an FM radio system usually provides about a 10dB improvement in the signal to noise ratio of the system, but the high frequency boost in the transmitter must be removed in a purely complementary manner or else the frequency response of the original audio signal will be altered.

Pre-emphasis can also cause distortion in the IF filtering stage in the receiver. As this signal is passed through the IF filters in the receiver, distortion can be produced, most noticeable at full modulation. De-emphasis cannot be applied until the signal is converted into audio, so there is no way around this problem short of eliminating pre-emphasis altogether. Neither of these problems occur in the 195 system. The dual-band compandor in the 195 Series system essentially provides a dynamic pre-emphasis/de-emphasis function with extremely low distortion.



The 195 system utilizes a separate ultrasonic tone modulation of the basic carrier to operate the receiver squelch. A 32kHz tone is injected into the audio signal after the microphone preamp, just after the compandor. The supersonic pilot tone is filtered out of the audio signal immediately after the detector in the receiver so that it does not influence the compandor or various gain stages. The basic benefit of the pilot tone squelch system is that the receiver will remain squelched (muted) until it receives the pilot tone from the matching transmitter, even if a strong RF signal is present on the carrier frequency of the system.

The high output antenna utilizes the lower half of the printed circuit boards as one radiating element, with the upper half of the PC boards and mic capsule as the other half of the dipole configuration. This allows the mic to be held in any position, since the user's hands have little or no effect on the radiated power.

75kHz deviation improves the capture ratio, signal to noise ratio and AM rejection of a wireless system dramatically. 75kHz deviation is frequently used in the UHF spectrum, but it is much harder to implement at VHF frequencies. The 195 system is the first to take advantage of this wider deviation now allowed by the FCC in the VHF spectrum. Almost all other VHF wireless systems use 15kHz deviation.

High efficiency circuits throughout the design allow over 4 hours of operation using a single 9 Volt alkaline battery and 12 hours with a lithium battery. The battery compartment is a unique mechanical design which automatically adjusts to fit any brand alkaline battery. Battery replacement is easily accomplished by releasing the bottom ring and removing the battery cover. No tools are needed to change the battery. The battery is spring loaded to prevent "rattle" as the unit is handled.

The VHF RF transmitter section is composed of a crystal stabilized main oscillator followed by a frequency tripler and two frequency doublers. The UHF transmitter section uses a crystal stabilized main oscillator followed by quad/double/double/double multiplier stages. The crystal controlled frequency is extremely stable over a wide temperature range and over time. Double tuning used in the multiplier stages provides higher attenuation of spurious emissions which, in turn, minimizes the possibility that the transmitter RF output would interfere with another transmitter/receiver system operating in the same vicinity.

CONTROLS AND FUNCTIONS

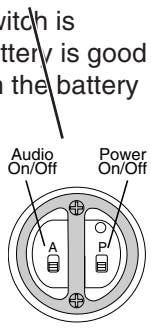
EXTERNAL

"P" SWITCH – POWER ON/OFF

A slide switch which turns battery power on and off. The LED next to the switch lights up when the "P" switch is turned on. This LED also serves as a battery condition indicator. The LED will glow brightly when the battery is good and will dim as the battery condition deteriorates. The LED is at full brightness with a new battery. When the battery voltage reaches 7 Volts, the LED will be completely dark.

"A" SWITCH – AUDIO ON/OFF

A slide switch which "mutes" the audio in the OFF position and allows the audio gain (modulation level) of the transmitter to be adjusted without feedback from the sound system.



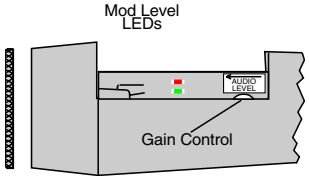
INTERNAL

MOD LEVEL LEDs

These LEDs indicate the audio input level and are used when adjusting the transmitter AUDIO LEVEL (gain) control. As the audio level increases, first one LED lights. The other LED lights as the audio level reaches maximum modulation. The LEDs are located underneath the battery cover, next to the AUDIO LEVEL control and are easily viewed when holding the transmitter in a normally used position.

AUDIO LEVEL

This knob (located underneath the battery door) is operated while speaking or singing into the transmitter to adjust the audio gain of the transmitter for the correct amount of modulation. The LEDs located next to it indicate the modulation level as the gain is adjusted. See page 6 for details on this very important adjustment.

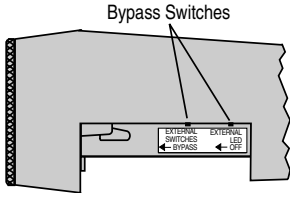


EXTERNAL SWITCHES BYPASS

This concealed slide switch defeats the external switches on the bottom panel for applications where it is best that the user not be able to operate the power and mute switches.

EXTERNAL LED OFF

This slide switch defeats the battery status LED on the bottom panel for applications where the LED may be distracting. With this switch in the right-hand position, the power will remain on and the transmitter operating, even though the power LED is off.



INTERNAL CONTROLS - SHURE SM87 VERSION

-10 dB

This switch enables an extra 10dB of audio attenuation for those rare times when the Audio Level control is already at minimum and the mic is still overloading.

The 10dB attenuator should only be used as a last resort. Do not leave it enabled when it is not needed.

To gain access to the switch, turn the windscreen counter-clockwise and remove it. Slide the switch handle toward the -10dB label to activate the attenuator. Factory default is NO attenuation.

INTERNAL CONTROLS - VARIMIC VERSION

Caution *- Due to the high RF levels surrounding the transmitter, the sound of the Varimic capsule may be temporarily affected if the metal windscreen is not in place. Always make the final decision about sound balance and quality with the windscreen in place.*

The VariMic head includes adjustments for Bass, Midrange and Treble response. There is also an attenuation adjustment to provide up to 15dB of additional headroom if needed.

BASS / MID / TREBLE

The bass and treble controls will boost/cut by up to approximately 8dB while the Mid control will boost/cut up to about 6dB. These controls operate as standard tone controls. Counter-clockwise will reduce the response in that band and clockwise will provide a true boost. These controls can be accessed by removing the windscreen. To remove the windscreen, grasp the body of the transmitter in one hand and the windscreen in the other hand. Carefully unscrew the wind-screen counter-clockwise until it comes off then carefully slide the windscreen past the mic element.

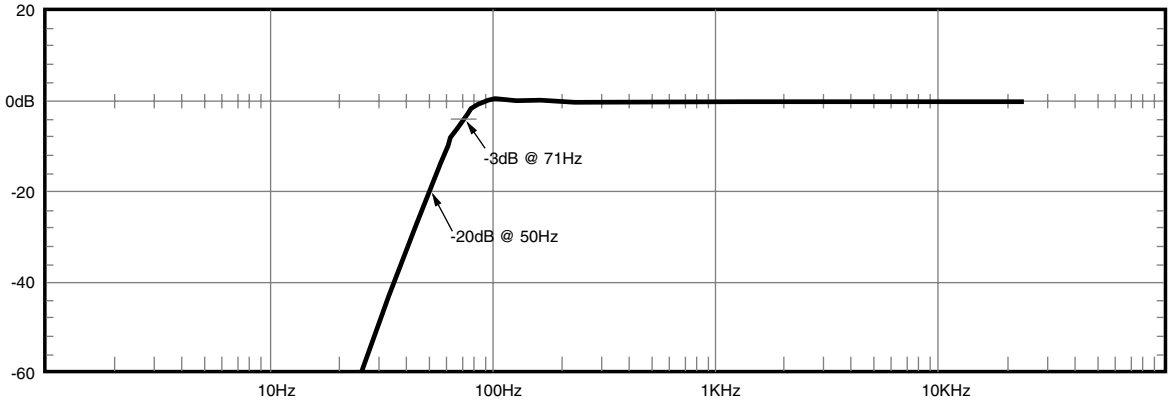
- Set flat, the mic capsule is very wide range and sounds a lot like a large competitor's top line condenser mic.
- Bass cut gives a dry but highly intelligible sound. Crisp.
- Bass boost "fattens" the sound but is very listenable. Does not get midbass boomy.
- Midrange cut sounds very smooth. Almost a "crooner" quality. A sweet sound.
- Midrange boost is likely to be useful in a system that is midrange shy.
- Treble cut has a "mellow" sound. The capsule has a solid high end so a little cut does not ruin the response.
- Treble boost might be fine on some sound systems. The sound doesn't get harsh (showing that the response was smooth) but sibilants are a little too much. Should be used in moderation.

Vari-Mic version

BASS FILTER

In addition to the tone controls, the UT200 also has a built in bass filter. This filter is fixed and cannot be adjusted or defeated. Low frequency noise is much more of a problem with wireless microphones than with conventional microphones. With a regular mic, low frequency wind noise, breath thumps or handling rumble can be filtered out at the control board before the noise causes problems with the following electronics or speaker systems. But with a wireless microphone, the electronics that will be overdriven are right in the wireless microphone. Filtering at the control board is much too late. To solve this problem, the VariMic has a low frequency filter that is so sharp that it can remove low frequency noise without affecting any wanted vocals. It consists of a 36 dB per octave filter circuit to sharply remove low frequency noise below 75 Hz without affecting vocal fundamentals. The lowest operatic bass voice fundamental is 82 Hz. See the curve below.

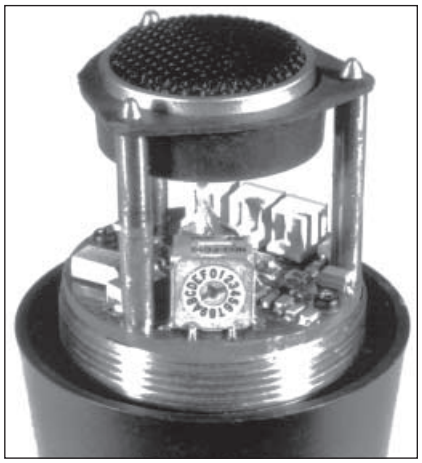
UT200 Bass Filter



ATTENUATOR

The VariMic head includes an attenuator to provide an additional 15dB of headroom when needed. The attenuator should only be used when the normal Mic Level pot is already turned down as far as it will go and the signal through the mic is still too hot. The attenuator control is a 16-position switch marked 0 through F. "F" is minimum attenuation or the highest signal level. "0" is maximum attenuation or the lowest signal level. For the maximum amount of headroom, set the switch to "0."

Note: The attenuator should not be used as a level control. The Audio Level control inside the battery compartment is the main level control. Adjust the attenuator only when the Audio Level control is turned completely down and more headroom is still needed. Be sure to set the attenuator back to its original setting for normal operation.

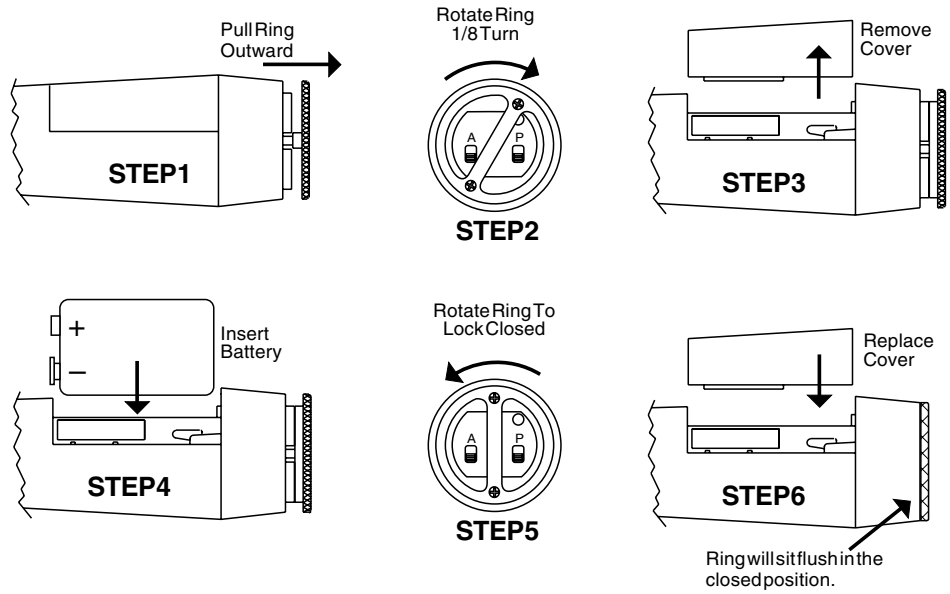


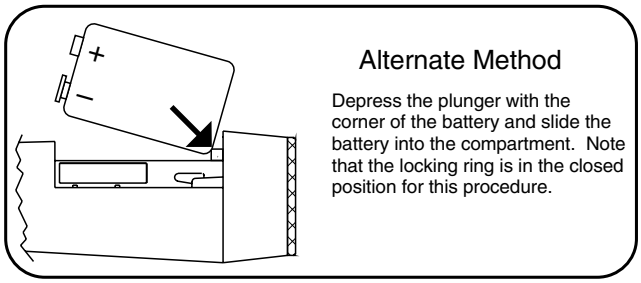
BATTERY INSTALLATION

The transmitter is powered by a standard alkaline 9 Volt battery. It is important that you use ONLY an ALKALINE battery for reliable operation. Alkaline batteries will provide about 4 hours of operation and lithium batteries will power the unit for 12 hours. The battery status lamp will function normally only with alkaline batteries. Standard zinc-carbon batteries marked “heavy duty” or “long-lasting” are not adequate. They will provide only about 2 hours of operation. Similarly, nicad rechargeable batteries only provide about 1.5 hours of operation, and will run down quite abruptly.

The battery compartment is located in the lower section of the transmitter, between two printed circuit boards. To install a fresh battery, follow the steps illustrated below. Look inside the battery compartment when the cover is off and take note of the two differently sized holes in the battery contact pad. Insert the battery so that the large hole in the battery contact pad will line up with the large contact on the battery when it is installed. The spring-loaded plunger in the bottom of the compartment (opposite the contact pad) secures the battery in place.

The battery status is indicated by an LED on the bottom panel. The LED will glow brightly when the battery is good and will dim as the battery condition deteriorates. The LED is at full brightness with a new battery.





OPERATING INSTRUCTIONS

1) Install a fresh battery according to the instructions on page 5. Leave the battery cover off for further adjustment.

2) Set the internal bypass slide switches so that the battery status LED and the bottom panel switches will operate.

3) On the bottom panel, move the "A" (audio) switch to "OFF" and the "P" (power) switch to ON (in that order). Observe that the battery status LED is brightly lit. If the LED is dim, replace the battery.

4) Hold the microphone in the same position that will be used in actual operation.

5) While speaking or singing at the same voice level that will be actually used, observe the MOD LEVEL LEDs next to the battery compartment. Adjust the AUDIO LEVEL control knob until the LEDs begin to light. Start at a low setting where neither LED lights as you speak. Gradually, turn the gain up until one LED lights, then the other.

The first LED lights when the audio level is about 10 dB below full modulation. The second LED lights when the limiter begins to operate. There is 30 dB of headroom above the limiter LED and it is normal that it lights up occasionally during use.

If you find that the AUDIO LEVEL control is set to minimum and the LIMIT LED is still on often, then set the –10 dB switch to the –10dB position. This switch is located under the windscreen. Unscrew the windscreen and carefully lift it off the top of the unit. Orient the unit so that the "–10 dB" label is toward you. In this position, when the switch handle is pushed toward the label, the 10dB pad is enabled. The unit is set to disable the 10 dB attenuator at the factory (switch handle pushed away from the label.)

6) Once the gain has been adjusted, the transmitter audio can be turned on to make sound system level adjustments. Set the "A" (audio) switch to ON position and adjust the receiver and/or sound system level as required. **Please note, there will be a delay between the moment the switch is thrown and the time when audio will actually pass through to the amplifier.** This intentional delay eliminates turn on thumps, and is controlled by the pilot tone squelch control.

OPERATING NOTES

The AUDIO LEVEL control knob should not be used to control the volume of your sound system. This gain adjustment matches the transmitter gain with the user's voice level and microphone positioning.

If the mic level is too high - both LEDs will light frequently or stay lit. This condition may cause distortion.

If the mic level is too low - neither LED will light, or the LEVEL LED will light dimly. This condition may cause hiss and noise in the audio.

The first LED turns on at -10dB below full deviation. The limiting LED turns on at full deviation and indicates that the input shunt compressor is operating. The input compressor operates over a full 20dB range regardless of the gain control setting. The compressor uses a true absolute value circuit to detect both positive and negative peaks. The attack time is 2 milliseconds and the release time is 80 milliseconds. Occasional limiting is desirable, indicating that the gain is correctly set and the transmitter is fully modulated for optimum signal to noise ratio.

Different voices will usually require different settings of the AUDIO LEVEL control, so check this adjustment as each new person uses the system. If several different people will be using the transmitter and there is not time to make the adjustment for each individual, adjust it for the loudest voice.

TROUBLESHOOTING

Before going through the following chart, be sure that you have a good battery in the transmitter. It is important that you follow these steps in the sequence listed.

SYMPTOM	POSSIBLE CAUSE
TRANSMITTER BATTERY LED OFF	1) External LED is turned off. Check internal slide switch. 2) Battery is inserted backwards. 3) Battery is dead, or too low to be used.
NO TRANSMITTER MOD LEVEL LEDs	1) Gain control turned all the way down. 2) Battery is in backwards. Check power LED. 3) Mic capsule is damaged or malfunctioning.
RECEIVER RF LAMP OFF	1) Transmitter not turned on. 2) Transmitter battery is dead. 3) Receiver antenna missing or improperly positioned. 4) Transmitter and receiver not on same frequency. Check labels on transmitter and receiver. 5) Operating range is too great.
NO SOUND AND RECEIVER VU METER DOES NOT INDICATE	Transmitter audio muted. Make sure bottom panel "A" switch is turned on. Push switch toward the letter "A" to turn the audio on.
NO SOUND BUT RECEIVER VU METER INDICATES	1) Receiver audio is muted or set too low. 2) Receiver audio output is disconnected or cable defective or mis-wired. 3) Sound system or recorder input is turned down.
DISTORTED SOUND AND/OR MOTORBOATING	1) Transmitter gain (audio level) is too high. Speak or sing into the transmitter and check mod level lamps on transmitter and receiver. (See page 6) 2) Receiver output level may be too high for the sound system or recorder input. 3) Excessive wind noise or breath "pops." Microphone may require an additional wind screen. 5) RF feedback getting into Vari-Mic mic capsule. Ensure that the windscreen is present and screwed down snugly.
HISS AND NOISE — AUDIBLE DROPOUTS	1) Transmitter gain (audio level) too low. 2) Receiver antenna missing or obstructed. 3) Operating range too great.
EXCESSIVE FEEDBACK	1) Transmitter gain (audio level) too high. Check gain adjustment and/or reduce receiver output level. 2) Microphone too close to speaker system. 3) Move microphone closer to the user's mouth, and lower the sound system volume.

SPECIFICATIONS

Operating Frequencies:	470 to 608 MHz
RF Power Output:	50mW on VHF
Pilot Tone:	32.768 kHz, ±2 Hz, 5kHz deviation
Frequency Stability:	±0.002%
Deviation:	± 75 kHz max
Spurious Radiation:	At least 50dB below carrier
Equivalent Input Noise:	–126 dBv
Input Level:	Maximum SPL depends on mic element used
Input Compressor:	Soft compressor, >40 dB range
Gain Control Range:	43 dB, semi-log rotary control
Modulation Indicators:	Dual LEDs indicate modulation level 12 dB below clipping and at the onset of limiting
Controls:	Power ON/OFF and Audio ON/OFF located on bottom of unit Bypass controls located inside battery door Gain control located inside battery door
Battery	Precision compartment auto-adjusts to accept any known alkaline 9 Volt battery. (We've tried 108 different ones.)
Weight:	13.2 ozs. with SM87 capsule and battery
Dimensions:	9.25" long x 1.9" diameter (at largest point) with SM87 capsule

Emission Designator: *180KF3E*

Specifications subject to change without notice.

SERVICE AND REPAIR

If your system malfunctions, you should attempt to correct or isolate the trouble before concluding that the equipment needs repair. Make sure you have followed the setup procedure and operating instructions. Check out the interconnecting cords and then go through the TROUBLE SHOOTING section in the manual

We strongly recommend that you **do not** try to repair the equipment yourself and **do not** have the local repair shop attempt anything other than the simplest repair. If the repair is more complicated than a broken wire or loose connection, send the unit to the factory for repair and service. Don't attempt to adjust any controls inside the units. Once set at the factory, the various controls and trimmers do not drift with age or vibration and never require readjustment. **There are no adjustments inside that will make a malfunctioning unit start working**.

LECTROSONICS service department is equipped and staffed to quickly repair your equipment. In-warranty repairs are made at no charge in accordance with the terms of the warranty. Out of warranty repairs are charged at a modest flat rate plus parts and shipping. Since it takes almost as much time and effort to determine what is wrong as it does to make the repair, there is a charge for an exact quotation. We will be happy to quote approximate charges by phone for out of warranty repairs.

RETURNING UNITS FOR REPAIR

You will save yourself time and trouble if you will follow the steps below:

A. DO NOT return equipment to the factory for repair without first contacting us by letter or by phone. We need to know the nature of the problem, the model number and the serial number of the equipment. We also need a phone number where you can be reached 8 am to 4 pm (Mountain Standard Time).

B. After receiving your request, we will issue you a return authorization number (R.A.). This number will help speed your repair through our receiving and repair departments. The return authorization number must be clearly shown on the outside of the shipping container.

C. Pack the equipment carefully and ship to us, shipping costs prepaid. If necessary, we can provide you with the proper packing materials. UPS is usually the best way to ship the units. Heavy units should be "double-boxed" for safe transport.

D. We also strongly recommend that you insure the equipment, since we cannot be responsible for loss of or damage to equipment that you ship. Of course, we insure the equipment when we ship it back to you.

Mailing address:
Lectrosonics, Inc.
PO Box 15900
Rio Rancho, NM 87174
USA

Shipping address:
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581 Laser Rd.
Rio Rancho, NM 87124
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Telephones:
Regular: (505) 892-4501
Toll Free (800) 821-1121
FAX: (505) 892-6243

orld Wide Web: *http://www.lectrosonics.com*

Email: *sales@lectrosonics.com*

LIMITED ONE YEAR WARRANTY

The equipment is warranted for one year from date of purchase against defects in materials or workmanship provided it was purchased from an authorized dealer. This warranty does not cover equipment which has been abused or damaged by careless handling or shipping. This warranty does not apply to used or demonstrator equipment.

Should any defect develop, Lectrosonics, Inc. will, at our option, repair or replace any defective parts without charge for either parts or labor. If Lectrosonics, Inc. cannot correct the defect in your equipment, it will be replaced at no charge with a similar new item. Lectrosonics, Inc. will pay for the cost of returning your equipment to you.

This warranty applies only to items returned to Lectrosonics, Inc. or an authorized dealer, shipping costs prepaid, within one year from the date of purchase.

This Limited Warranty is governed by the laws of the State of New Mexico. It states the entire liablility of Lectrosonics Inc. and the entire remedy of the purchaser for any breach of warranty as outlined above. NEITHER LECTROSONICS, INC. NOR ANYONE INVOLVED IN THE PRODUCTION OR DELIVERY OF THE EQUIPMENT SHALL BE LIABLE FOR ANY INDIRECT, SPECIAL, PUNITIVE, CONSEQUENTIAL, OR INCIDENTAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THIS EQUIPMENT EVEN IF LECTROSONICS, INC. HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. IN NO EVENT SHALL THE LIABILITY OF LECTROSONICS, INC. EXCEED THE PURCHASE PRICE OF ANY DEFECTIVE EQUIPMENT.

This warranty gives you specific legal rights. You may have additional legal rights which vary from state to state.

LECTROSONICS, INC.

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RIO RANCHO, NM 87124 USA

November 1, 2001