# SM

## Super Miniature Belt-Pack Transmitter

### Including SMD, SMQ

## With Digital Hybrid Wireless™ Technology

Fill in for your records:

Serial Number:

Purchase Date:

**LECTROSONICS®**
Rio Rancho, NM, USA
www.lectrosonics.com

Thank you for selecting the Lectrosonics SM ultra-miniature transmitter. The unique design provides several distinct features for professional applications:

Outstanding RF operating range

Superb audio quality

Ultra-lightweight, corrosion resistant housing

Water resistant seals for use in damp environments

Programmable compatibility modes for maximum versatility

The Digital Hybrid Wireless™ design (US Patent Pending) combines 24-bit digital audio with analog FM resulting in a system that has the same operating range as analog systems (plus the graceful failure at the limits of that range), the same spectral efficiency as analog systems, the same long battery life as analog systems, but with the excellent audio found in digital systems.

The SM uses a standard Lectrosonics 5-pin type input jack for use with electret lavaliere mic, dynamic mic, or line level signals.  A water resistant control panel with LCD, membrane switches and multi-color LEDs make input gain adjustments and frequency and compatibility mode selection quick and accurate, without having to view the receiver.  The battery compartment accepts an AA lithium battery.  Plus, the SM is machined from a solid aluminum block to provide an extremely light-weight and rugged package.  A special non-corrosive finish (the same one used by NASA) resists salt water exposure and perspiration in extreme environments.

The DSP-based design works with all Digital Hybrid recievers, and is backward compatible with Lectrosonics 200 and 100 Series and IFB receivers and some other brands of analog wireless receivers.  Only the SM transmitter is covered in this manual.  Companion receivers are covered in separate manuals.

# Table of Contents

# General Technical Description

## Introduction

The SM transmitter uses ±75 kHz wide deviation for an extremely high signal to noise ratio, switching power supplies to provide constant voltages to the transmitter circuits from the beginning (1.5 Volts) to the end (0.85 Volts) of battery life, and an ultra low noise input amplifier for quiet operation. It is gain protected with a wide range dual envelope input limiter which cleanly limits input signal peaks over 30 dB above full modulation.

## Servo Input

The SM input is a radically different input system compared to previous Lectrosonics transmitter microphone inputs. It is so superior that this input system will eventually be utilized by all Lectrosonics UHF transmitters. This may cause some confusion but the advantages are very real. The improvements are audible and make the transmitters easier to use and much harder to overload. It is no longer necessary on some mics to introduce pads to prevent overload of the input stage, divide the bias voltage down for some low voltage mics, or reduce the limiter range at minimum gain settings.

## Digital Hybrid Wireless™ Technology*

All wireless links suffer from channel noise to some degree, and all wireless microphone systems seek to minimize the impact of that noise on the desired signal. Conventional analog systems use compandors for enhanced dynamic range, at the cost of subtle artifacts (known as "pumping" and "breathing"). Wholly digital systems defeat the noise by sending the audio information in digital form, at the cost of some combination of power, bandwidth and resistance to interference.

Lectrosonics Digital Hybrid Wireless™ systems overcome channel noise in a dramatically new way, digitally encoding the audio in the transmitter and decoding it in the receiver, yet still sending the encoded information via an analog FM wireless link. This proprietary algorithm is not a digital implementation of an analog compandor but a technique that can be accomplished only in the digital domain, even though the inputs and outputs are analog.

Channel noise still impacts received signal quality and will eventually overwhelm a receiver. Digital Hybrid Wireless™ simply encodes the signal to use a noisy channel as efficiently and robustly as possible, yielding audio performance that rivals that of wholly digital systems, without the power and bandwidth problems inherent in digital transmission.

Because it uses an analog FM link, Digital Hybrid Wireless™ enjoys all the benefits of conventional FM wireless systems, such as excellent range, efficient use of RF spectrum, and resistance to interference. However, unlike conventional FM systems, it does away with the analog compandor and its artifacts.

## No Pre-Emphasis/De-Emphasis

The Digital Hybrid Wireless™ design results in a signal-to-noise ratio high enough to preclude the need for conventional pre-emphasis (HF boost) in the transmitter and de-emphasis (HF roll off) in the receiver.

## Low Frequency Roll-Off

A 12 dB per octave low frequency roll-off is provided in the audio section, with the -3 dB point at 70 Hz. The

**\*US Patent Pending**



SM Block Diagram
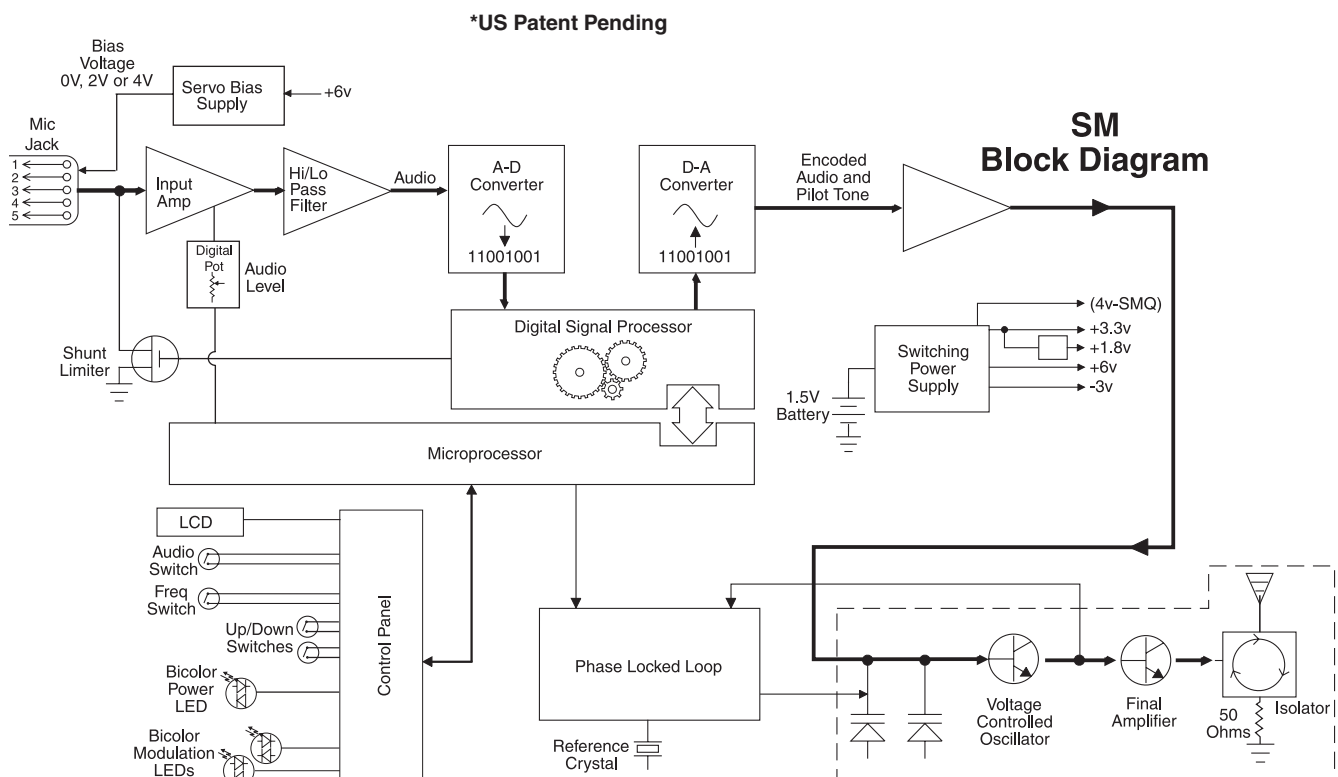
actual roll-off frequency will vary somewhat according to the low frequency response of the mic capsule being used.

The low frequency roll-off is used to remove subsonic (or very low frequency) audio, often produced by air conditioning systems, automobile traffic and other sources from the audio signal. Excessive low frequency content in the audio input can cause a variety of audio problems including driving the transmitter into limiting.

## Input Limiter

A DSP-controlled analog audio limiter is employed before the analog-to-digital converter. The limiter has a range of more than 30 dB for excellent overload protection. A dual release envelope makes the limiter acoustically transparent while maintaining low distortion. It can be thought of as two limiters in series, connected as a fast attack and release limiter followed by a slow attack and release limiter. The limiter recovers quickly from brief transients, so that its action is hidden from the listener, but recovers slowly from sustained high levels, to both keep audio distortion low and preserve short term dynamic changes.

Two bicolor LEDs indicate limiter activity. (See *Operating Instructions, Adjusting Audio Levels.*)

## Digital Signal Processor

The DSP encodes the digitized audio from the A-D Converter and adds an ultrasonic Pilot Tone to control the receiver's squelch (only in 400 Series, 200 Series, IFB Compatibility Mode, and Mode 6 – see *Pilot Tone Squelch*). It also controls the input limiter.

## Microprocessor, PLL and VCO Circuits

An 8-bit microprocessor monitors user command inputs from the Control Panel buttons and numerous other internal signals. It works intimately with the DSP to ensure the audio is encoded according to the selected Compatibility Mode and the correct pilot tone is added to the encoded signal. (See *Pilot Tone Squelch.*) It also drives the LCD display and operates the PLL/VCO circuits.

## Compatibility Modes

The SM transmitter was designed to operate with Lectrosonics 400 Series receivers and will yield the best performance when doing so. However, due to the flexibility of digital signal processing, the SM is also able to operate with Lectrosonics 200 Series, Lectrosonics 100 Series, IFB and certain non-Lectrosonics receivers in special compatibility modes. (Contact the Lectrosonics Sales Department for a complete list of non-Lectrosonics compatible receivers.)

## Pilot Tone Squelch

A fixed frequency pilot tone squelch system (such as Lectrosonics 200 Series) ensures that a receiver remains 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 400 Series (Digital Hybrid Wireless™) takes this a step further by using one of 256 different ultrasonic tones between 25 kHz and 32 kHz to modulate the carrier and operate the receiver squelch. The pilot tone frequency is chosen according to which of the 256 channels has been selected. (See *SM Screen Selections*.)

This ensures that all transmitters in a system have different pilot tone frequencies so that even spurious RF from the wrong transmitters can't open the receiver squelch.

## Control Panel

A waterproof control panel which includes four membrane switches and an LCD screen is used to set and adjust the operational settings, and also provide a visual feedback of overall system operation. (See *Controls and Functions.*)

## Wide-Band Deviation

A ±75 kHz deviation improves the capture ratio, signal to noise ratio and AM rejection of a wireless system dramatically, compared to other designs that use 30 kHz to 40 kHz deviation. This combined with a full 100 mW of power output makes a significant improvement in signal to noise ratio and maximum operating range.

## Battery Life

Switching power supplies throughout the design allow about 4.5 hours of operation using a single AA lithium battery (Two AA batteries for the SMD/Q). If shorter operating times are acceptable, an alkaline or NiMH battery can be used. In the SM, AA alkaline batteries provide about 2 hours of operation, and a NiMH AA battery provides about 3.5 hours of operation.

> *Note: A NiMH battery will give little or no warning when it is depleted. If you wish to use NiMH batteries, we recommend trying fully charged batteries in the unit, noting the length of time that the batteries will run the unit and then using the battery timer feature available on most 400 Series receivers.*

The battery contact is designed to prevent "rattle" as the unit is handled.

## Frequency Agility

The transmitter section uses a synthesized, frequency selectable main oscillator. The frequency is extremely stable over a wide temperature range and over time. 256 frequencies in 100 kHz steps over a 25.5 MHz range are available.

## Circulator/Isolator

The RF output circuit includes a one way circulator/isolator using a magnetically polarized ferrite. This device greatly reduces RF intermodulation produced when multiple transmitters are used at separations of less than five feet. It also provides additional RF output stage protection but is rarely seen in a wireless microphone transmitter due to its high cost.

# Controls and Functions
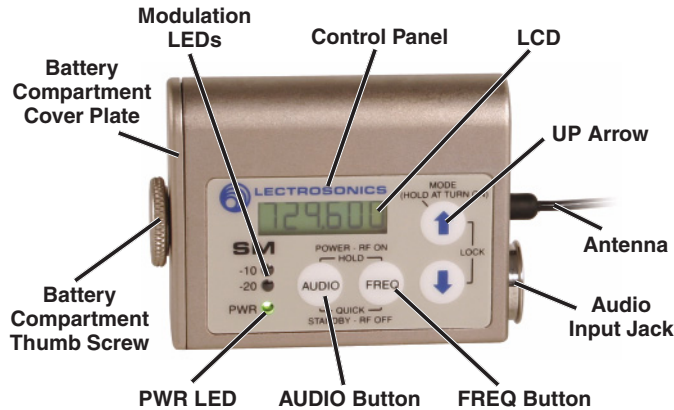
Modulation LEDs
Control Panel
LCD
Battery Compartment Cover Plate
UP Arrow
Antenna
Battery Compartment Thumb Screw
Audio Input Jack
PWR LED
AUDIO Button
FREQ Button

| Signal Level | -20 LED | -10 LED |
|---|---|---|
| Less than -20 dB | Off | Off |
| -20 dB to -10 dB | Green | Off |
| -10 dB to +0 dB | Green | Green |
| +0 dB to +10 dB | Red | Green |
| Greater than +10 db | Red | Red |

## LCD Screen

The LCD is a numeric-type Liquid Crystal Display used in conjunction with the AUDIO and FREQ buttons, and the UP and Down arrows, to configure the SM. (See SM SCREEN SELECTIONS.) It is also used with the Modulation and PWR LEDs to monitor system operation.

## Power LED

The PWR LED glows green when the battery is good. The color changes to red when there is about 30 minutes of operation left with the recommended lithium battery. (An alkaline battery will have about 20 minutes of life left.) When the LED begins to blink red, there are only a few minutes of life.

> Note: A NiMH battery will give little or no warning when it is depleted. If you wish to use NiMH batteries in the SM, we recommend trying fully charged batteries in the unit, noting the length of time that the batteries will run the unit and then using the battery timer feature available on most 400 Series receivers.

A weak battery will sometimes cause the PWR LED to glow green immediately after being put in the unit, but will soon discharge to the point where the LED will go red or shut off completely. When the SM is in SLEEP mode, the LED blinks green every few seconds (See *Sleep Mode*, page X).

## Audio Input Jack

The input on the SM accommodates virtually every lavaliere, handheld or shotgun microphone available. Different line level signals can also be accommodated. (See *LINE LEVEL SIGNALS* and *5-PIN INPUT JACK WIRING*.)

## Modulation LEDs

The Modulation LEDs provide a visual indication of the input audio signal level from the microphone. These two bicolor LEDs can glow either red or green to indicate modulation levels.

## Audio Button

The AUDIO button is used to display the audio level setting (0 dB to 44 dB) on the LCD and used in conjunction with the Up and Down arrows to adjust the audio level input from the microphone.

The AUDIO button is also used with the FREQ button to enter standby mode and to power the transmitter on or off.

## Freq Button

The SM provides 256 individual frequencies, in 100 kHz increments, across a 25.5 MHz frequency block. The FREQ Button displays the selected operating frequency and also toggles the LCD between displaying the actual operating frequency in MHz and a two-digit hexadecimal number that corresponds to the equivalent Lectrosonics Frequency Switch Setting.

The FREQ button is also used with the AUDIO button to enter standby mode and to power the transmitter on or off.

## Up/Down Arrows

The Up and Down arrow buttons are used to select the operating frequency, adjust the audio level, or set the Compatibility Mode.

Pressing both arrows simultaneously enters the lock countdown. Holding the two arrow buttons until the countdown completes locks the control panel buttons so they can only be used to display current settings. "Loc" is displayed to indicate the controls are locked.

Once locked, the buttons can be unlocked only by removing the battery, or via the remote control (if enabled).

## Antenna

The fixed flexible cable antenna is supplied with the transmitter. This antenna is cut to the 1/4 wavelength of the center of the frequency block (the frequency range) of the transmitter.

## Battery Compartment and Thumb Screw

The large knurled thumbscrew is used to release or secure the Battery Compartment Cover Plate, allowing access to the battery.

# SM Screen Selections

Six screens are used to set up and operate the SM. These screens are used to set the operating frequency, adjust the audio modulation level, select the Compatibility Mode or lock the control panel and power down the transmitter.

## Audio Screen

The Audio screen is the default screen at the end of the power up boot sequence. It can also be accessed by pressing the AUDIO button during normal operation.

| Aud  12 |
|:---:|

The Audio screen displays the current audio input level setting.

## Frequency Screen

The Frequency Screen displays the operating frequency in MHz or as a two-digit hexadecimal number that corresponds to the equivalent Lectrosonics Frequency Switch Setting. Pressing the FREQ button toggles between the two displays.

| 644.400 |
|:---:|
| **CH   2C** |

When the operating frequency is displayed in MHz, the decimal point also acts as the PLL lock indicator. If the decimal point is constantly blinking or missing, this indicates that the transmitter is having RF problems. (See *Troubleshooting, Receiver RF Indicator Off*.)

## Compatibility Mode Screen

Holding down the Up arrow button while powering up the SM opens the Compatibility Mode screen. By using the Up

| CP 400 |
|:---:|

or Down arrow buttons, the user can select one of six compatibility modes:

Note: RF transmission is prevented while selecting Compatibility Modes. Also, the SM exits the Compatibility Mode screen to Standby Mode. (See *Standby Mode*, page 8.)

- 400 - This is the factory default setting and works with all Lectrosonics 400 Series Digital Hybrid Wireless™ receivers. This mode offers the best audio quality.

- 200 - This mode works with all Lectrosonics 200 Series compatible receivers.

- 100 - This mode works with all Lectrosonics 100 Series compatible receivers.

- 3 - (Mode 3) This mode works with a number of non-Lectrosonics analog receivers. Contact the company for a list of compatible receivers.

- IFB - This mode works with all Lectrosonics IFB compatible receivers.

- 6 - (Mode 6) This mode works with a number of non-Lectrosonics analog receivers. Contact the company for a list of compatible receivers.

While in the compatibility mode screen, pressing either the AUDIO or FREQ button exits to standby mode. To power off from the compatibility mode screen, press AUDIO and FREQ together.

## Lock/Unlock Screen

Simultaneously pressing both the Up and Down arrow buttons during normal operation starts the Lock timer. The timer starts at three and counts down to zero.

| Loc    1 |
|:---:|

When the timer reaches zero, the transmitter's controls are locked.

The LCD will display the locked condition as long as the arrow buttons are held, then revert back to the previous screen when either button is released.

| unLoc1 |
|:---:|

With the controls locked, the AUDIO and FREQ buttons can still be used to display current settings. Any attempt to change a setting by pressing either the Up or Down arrow button will result in a reminder that the controls are locked.

*Important: Once the transmitter is locked, it cannot be unlocked or powered off using the buttons. The only ways to unlock a locked transmitter are to remove the battery or unlock it via the remote control. The remote control will work only if the transmitter was previsouly configured to respond to the remote control. Lock mode does not persist when the power is off.*

## Power On Timer Screen

Simultaneously holding the AUDIO and FREQ buttons when the unit is turned off displays the Power ON Timer screen. The screen counts up

| On . . .1 |
|:---:|
| **Initial Power On Timer Screen** |

from one and starts the Power On sequence when the count reaches three. Releasing either button prior to the Power On Timer screen reaching three puts the unit in Standby Mode where the user can review transmitter frequency and audio level settings without transmitting. (See *Standby Mode*, page 8.)

## Power Off Timer Screen

Simultaneously holding the AUDIO and FREQ buttons while the unit is operating displays the Power Off Timer screen. The screen counts down from three and turns off

| oFF . . .3 |
|:---:|
| **Initial Power Off Timer Screen** |

the transmitter when it reaches zero. Releasing either button prior to the Power Off Timer screen indicating zero returns the unit to normal operation and displays the previous screen.

## Standby Mode

Quickly pressing both the AUDIO and FREQ buttons from a power off condition places the unit in Standby Mode.  In this mode, the screen displays "rf OFF" to inform the user that the unit is not transmitting.

| rF OFF |
| --- |

**Standby Screen**

Holding the FREQ button in Standby Mode displays the current operating frequency of the transmitter.  The operating frequency can be changed by holding the FREQ button and pressing either the Up or Down button.  Release the FREQ button, then press and hold it again to toggle the display between frequency in MHz and the hex code corresponding to the equivalent Lectrosonics Frequency Switch Setting.

Holding the AUDIO button in Standby Mode displays the current audio input level setting.  This level can be changed by holding the AUDIO button and pressing either the Up or Down button.

Quickly pressing both the FREQ and AUDIO buttons simultaneiously when the unit is in Standby Mode powers off the transmitter.

## Remote Control Operation

Note: A remote control (Lectrosonics model RM) is available to change certain settings on the SM in situations where the controls would be difficult to access, for example, when the transmitter has been placed underneath an elaborate costume. The RM is not included with the SM.

The SM transmitter may be configured to respond to signals from the remote control or to ignore them. This setting is accessed by holding down the the Down arrow button while powering the transmitter on. Use the arrow keys to toggle between "rc on" (remote control on) and "rc oFF" (remote control off). The default setting

If a remote control signal is detected but the transmitter is set to "rc oFF", the message "rc oFF" will be displayed briefly on the transmitter's LCD, to confirm that a valid signal was received, but that the transmitter is not configured to respond to it.

Functions available from the remote control are:

- Audio Level
- Frequency
- Lock/Unlock Buttons
- Sleep/Wake (power saving mode)

In sleep mode, the SM uses one fifth the normal amount of current. For example, in sleep mode it will drain the battery as much in five hours as it would do in one hour of normal operation. Sleep mode can only be invoked with the remote control, and can only be revoked with the remote control or by removing the battery.  When in sleep mode, the PWR LED blinks green occasinally to indicate that the SM is asleep and not turned off.
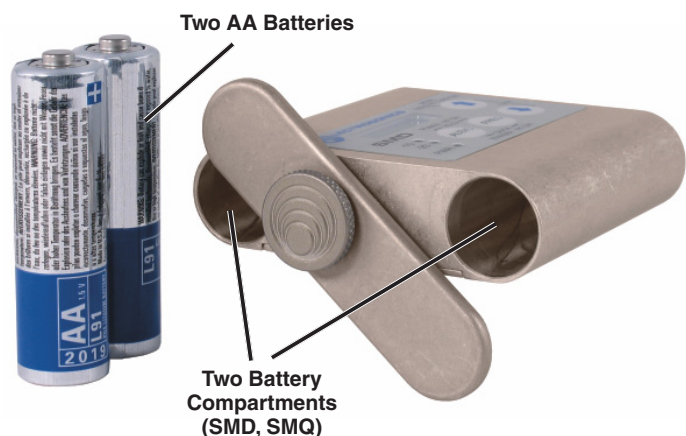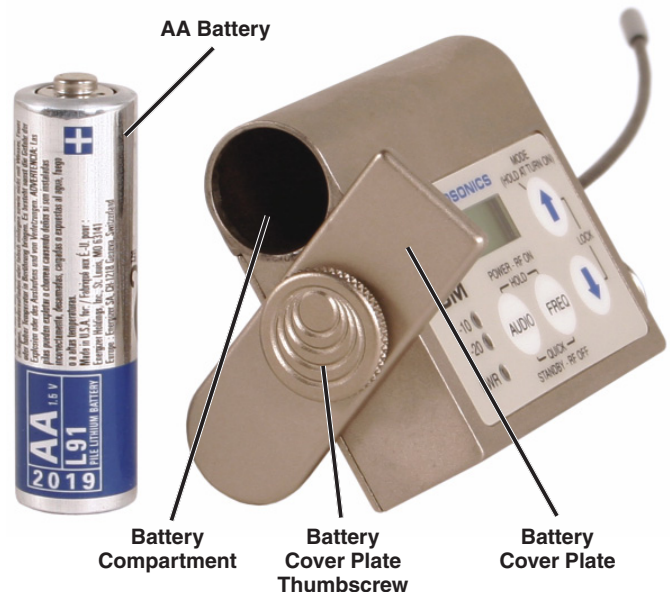
# Battery Installation

The SM transmitter is powered by a single standard AA 1.5 volt battery, while the SMD and SMQ use two AA batteries.  We recommend using lithium batteries for longest life.  In the SM, lithium batteries provide over 4.5 hours of operation at room temperature.

Note: Standard zinc-carbon batteries marked **"heavy-duty"** or **"long-lasting"** are not adequate.

The battery status circuitry is designed for the voltage drop over the life of lithium batteries.

To install new batteries:

1. Turn the Battery Cover Plate Thumbscrew counter-clockwise, open the battery compartment and remove any old batteries.

2. Insert the new battery (or batteries) into the housing.  Take note of the polarity marked on the case showing the location of the positive (+) and negative (-) terminals.  The positive (+) battery terminal goes into the transmitter first.

3. Replace the Battery Cover Plate and tighten the Battery Cover Plate Thumbscrew.

**AA Battery**

**Battery Compartment**   **Battery Cover Plate Thumbscrew**   **Battery Cover Plate**

**Two AA Batteries**

**Two Battery Compartments (SMD, SMQ)**

# Operating Instructions

## Power Up and Boot Sequence

1) Ensure that a good battery is installed in the unit. (See *Battery Installation*.)

2) Simultaneously press and hold the AUDIO and FREQ buttons until the Power On Boot Sequence is initiated. (See Power On Timer.) As the unit turns on, the Modulation LEDs and PWR LED all glow red, then green, and then they revert to normal operation, i.e., the Modulation LEDs glow according to the audio level present at the Audio Input Jack and the PWR LED glows green (with a good battery).

The LCD displays a bootup sequence which consists of four screens:

| | |
|---|---|
| Company Name: | Lectro |
| Frequency Block (bXX) and Firmware Version (rX.X): | b21r1.1 (typ) |
| Compatibility Mode: | CP 400 (typ) |
| Audio: | Aud 12 (typ) |



**Modulation LEDs** **Control Panel** **LCD**

**UP Arrow**

**PWR LED** **AUDIO Button** **FREQ Button**
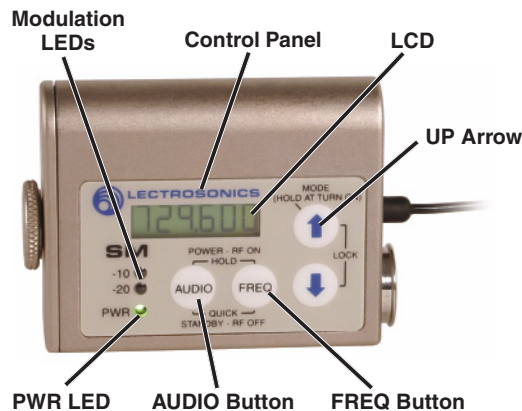
## Power Down

1) Simultaneously press and hold the AUDIO and FREQ buttons while observing that the word "Off" appears in the LCD along with a counter.

**OFF...3**

**Initial Power Off Timer Screen**

2) When the counter reaches "0", the unit turns off.

Note: If the AUDIO and FREQ buttons are released before the LCD goes blank at the end of the countdown, the unit will not turn off. Instead, it will stay energized and the display will return to the previous screen.

## Standby Mode

Standby Mode allows the user to verify or change the transmitter's operating frequency or audio input level, and lock or unlock the front panel controls without transmitting any signals. Standby Mode can only be invoked from a power off condition.

Quickly press and release both the AUDIO and FREQ buttons simultaneously to enter and exit this mode.

## Selecting the Compatibility Mode

All Digital Hybrid Wireless™ receivers are capable of working with the Lectrosonics SM transmitter. By selecting the proper compatibility mode, the SM will also work with 200 Series, 100 Series and IFB analog receivers, plus some other analog wireless receivers (contact the factory for details). Setting the Compatibility Mode of the transmitter to match the receiver is easily done via the Control Panel.

Note: RF transmission is prevented while selecting Compatibility Modes. Also, the SM exits the Compatibility Mode screen to Standby Mode. (See Standby Mode, this section.)

Note: The unit comes from the factory configured as a 400 Series transmitter.

1) Set the receiver's audio controls to minimum.

2) Power up the SM and observe the Boot Sequence. If the Compatibility Mode for the SM does not match the corresponding receiver, then power off the SM transmitter.

3) From a power off condition, hold down the Up arrow, then simultaneously press the AUDIO and FREQ buttons.

4) The LCD will display the current Compatibility Mode. Use the Up or Down arrow buttons to reset the Compatibility Mode to match the corresponding receiver.

**CP 400**

**400 Series or Digital Hybrid Wireless™ Compatibility Mode**

The following Compatibility Modes are available:

| | |
|---|---|
| • 100 Series mode: | CP 100 |
| • 200 Series mode: | CP 200 |
| • Mode 3 (Contact dealer for details): | CP 3 |
| • 400 Series mode: | CP 400 |
| • IFB Series mode: | CP IFB |
| • Mode 6 (Contact dealer for details): | CP 6 |

5) The Compatibility Mode selected in Step 4 will be the current Compatibility Mode until reset using this procedure. Pressing the AUDIO or FREQ exits into Standby Mode. To power off from the compatibility mode screen, press AUDIO and FREQ together.

## Setting Transmitter Operating Frequency

The Operating Frequency of the SM can be displayed either in MHz or as a two-digit hexadecimal number. (See *Controls and Functions, FREQ Button*.)  The SM's operating frequency can be set with the unit in Standby Mode or powered up for normal operation. Use the following procedure to change the Operating Frequency of the SM transmitter:

1)  If the LCD is displaying something other than the Frequency Screen, press the FREQ button on the SM Control Panel to enter this screen.

Note: The default display is in MHz.  Pressing the FREQ button again displays the operating frequency as a two-digit hexadecimal number that corresponds the equivalent Lectrosonics Frequency Switch Setting.

2)  While holding the FREQ button, use the Up or Down arrow buttons to move the operating frequency up or down in 100 kHz increments from the current setting.

Note: The operating frequency displayed on the LCD wraps as it reaches the upper or lower end of its range.  Thus, if you intend to move the operating frequency from the lower end of the range to the upper end, it may be faster to do this by using the Down arrow until the frequency wraps to the upper end.

Most Lectrosonics receivers indicate the operating frequency both in MHz and as a two digit hexadecimal number.  This conforms to the Lectrosonics tradition of setting the operating frequency using two 16-position rotary switches. The SM offers the ability to set the operating frequency in a similar manner.  Pressing the FREQ button while the LCD displays the operating frequency in MHz will change the display to show the equivalent two-digit hexadecimal frequency select switch setting.  Simply use the Up or Down arrow to increase or decrease the operating frequency.

| 644.400 |
| :---: |
| **Frequency displayed in MHz** |

| CH   2C |
| :---: |
| **Frequency displayed as two-digit hexadecimal number** |



Modulation LEDs    Control Panel    LCD

UP Arrow

PWR LED    AUDIO Button    FREQ Button
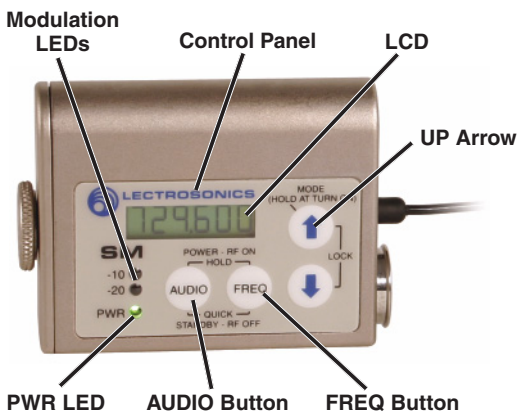
## Attaching a Microphone and Adjusting Gain

The front panel Modulation LEDs indicate limiter activity. (See chart below.)  Once set, the transmitter's audio level setting **should not** be used to control the volume of your sound system or recorder levels.  This gain adjustment matches the transmitter gain with the microphone's output level, the user's voice level and the microphone's position.  The audio input level can be set with the unit in Standby Mode or powered up for normal operation.

| Signal Level | -20 LED | -10 LED |
| :--- | :--- | :--- |
| Less than -20 dB | Off | Off |
| -20 dB to -10 dB | Green | Off |
| -10 dB to +0 dB | Green | Green |
| +0 dB to +10 dB | Red | Green |
| Greater than +10 db | Red | Red |

Note: Different voices will usually require different settings of the AUDIO 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.

1)  With the SM powered off, insert the microphone plug into the Audio Input Jack, aligning the pins and ensuring that the connector locks.

2)  Place the SM in Standby Mode, or if the unit is to be powered up and adjusted, mute the main sound system prior to powering up the transmitter.

3)  Position the microphone in the location where it will be used in actual operation.

4)  Observe the SM Modulation LEDs while speaking or singing into the microphone at the same voice level that will be used during the program.  While holding the AUDIO button, press the Up or Down arrow buttons until the both the -20 and -10 LEDs glow green, with the -10 LED occasionally flickering red  (-10 dB to +0 dB Signal Level as shown in the chart below with only occasional forays into the +0 dB to +10 dB range).

Note: Setting the audio level too high reduces the dynamic range of if the audio signal.  Setting the audio level too low may cause hiss and noise in the audio.

5)  If the unit was set up in Standby Mode, it will be necessary to power up the SM and adjust the remaining components of the audio system prior to use.

# Locking or Unlocking the Control Panel

The Lock mode protects the transmitter from accidental changes to its settings.

1. Ensure the SM setup is complete (operating frequency, audio level, Compatibility Mode, sensitivity to remote control).

2. Simultaneously press both the Up and Down arrow buttons to start the Lock timer.  When the timer reaches zero, "Loc" is displayed and the controls are locked.

| $\text{L}_{\text{OC}}$ |
|:---:|

**Control Panel Locked**

*Important: Once the transmitter is locked, it cannot be unlocked or powered off using the buttons.  The only ways to unlock a locked transmitter are to remove the battery or unlock it via the remote control.  The remote control will work only if the transmitter was previsouly configured to respond to the remote control.  Lock mode does not persist when the power is off.*

# 5-Pin Input Jack Wiring

The wiring diagrams included in this section represent the basic wiring necessary for the most common types of microphones and other audio inputs. Some microphones may require extra jumpers or a slight variation on the diagrams shown.

It's virtually impossible to keep completely up to date on changes that other manufacturers make to their products. It is possible that you may encounter a microphone that differs from these instructions. If this occurs please call our toll-free number listed under Service and Repair in this manual or visit our web site at:

**http://www.lectrosonics.com**

The Audio Input Jack for the SM is wired as shown below:

**Audio Input Jack**



**SM Equivalent Input Circuit Wiring**
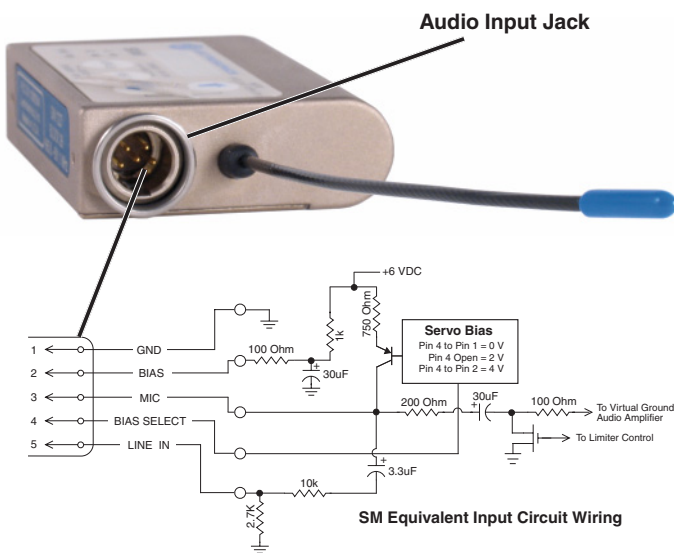
**PIN 1** Shield (ground) for positive biased electret lavaliere microphones. Shield (ground) for dynamic microphones and line level inputs.

**PIN 2** Bias voltage source for positive biased electret lavaliere microphones.

**PIN 3** Low impedance microphone level input for dynamic microphones. Also accepts hand-held electret microphones provided the microphone has its own built-in battery.

**PIN 4** Bias voltage selector for Pin 3. Pin 3 voltage (0, 2 or 4 volts) depends on Pin 4 connection.

> Pin 4 tied to Pin 1:　0 V
> Pin 4 Open:　　　　2 V
> Pin 4 to Pin 2:　　4 V

**PIN 5** High impedance, line level input for tape decks, mixer outputs, musical instruments, etc.

## Microphone RF Bypassing

When used on a wireless transmitter, the microphone element is in the proximity of the RF coming from the transmitter. The nature of electret microphones makes them sensitive to RF, which can cause problems with the microphone/transmitter compatibility. If the electret microphone is not designed properly for use with wireless transmitters, it may be necessary to install a chip capacitor in the mic capsule or connector to block the RF from entering the electret capsule.

Some mics require RF protection to keep the radio signal from affecting the capsule, even though the transmitter input circuitry is already RF bypassed (see schematic diagram).

If the mic is wired as directed, and you are having difficulty with squealing, high noise, or poor frequency response; RF is likely to be the cause.

The best RF protection is accomplished by installing RF bypass capacitors at the mic capsule. If this is not possible, or if you are still having problems, capacitors can be installed on the mic pins inside the TA5F connector housing.

**2 WIRE MIC**　　　　　**3 WIRE MIC**
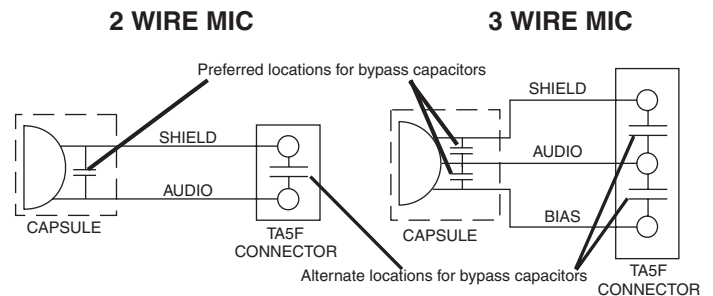


Install the capacitors as follows: Use 330 pF capacitors. Capacitors are available from Lectrosonics. Please specify the part number for the desired lead style.

> Leaded capacitors:　P/N 15117
> Leadless capacitors: P/N SCC330P

All Lectrosonics lavaliere mics are already bypassed and do not need any additional capacitors installed for proper operation.

## Line Level Signals

The normal hookup for line level signals is: Signal Hot to pin 5, Signal Gnd to pin 1 and pin 4 jumped to pin 1. This allows signal levels up to 6V RMS to be applied without limiting.
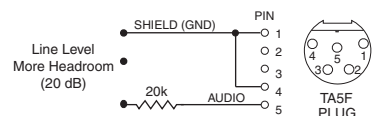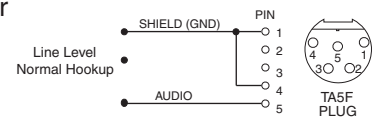
If more headroom is needed, insert a 20 k resistor in series with pin 5. Put this resistor inside the TA5F connector to minimize noise pickup.

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# Wiring Hookups for Different Sources

In addition to the wiring hookups illustrated below, Lectrosonics makes a number of cables and adapters for other situations such as connecting musical instruments (guitars, bass guitars, etc.) to the transmitter. These cables can be found in our UHF or Accessories catalogs. Visit www.lectrosonics.com, or contact the factory for more information.

he most radical change is that pin 4 is now a voltage selector pin. The diagrams in the section labeled "Works with SM only" are specific to the SM transmitter and make wiring a Countryman B6 or E6 or a three wire microphone such as a COS-11 very quick and easy. However, these wirings won't work with older Lectrosonics transmitters such as the UM400, UM200, etc. If you need the two wire Countryman B6 or any three wire mic to work with both older transmitters as well as with the SM go to the section below, labeled, "Compatible with SM and other Lectrosonics Transmitters."
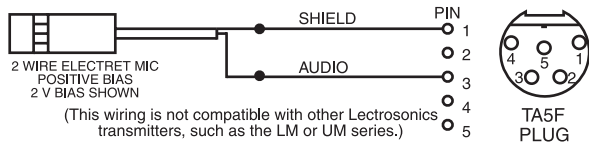
Sanken Cos-11 microphones, the Lectrosonics M150 and other three wire microphones to be used with the

SM will require new wiring. If the wiring is not changed, they will have much higher output than usual and extra distortion at high levels. The reason is that the source follower wiring used with the UM200 and UM400 series is not compatible with the SM virtual ground input. The second diagram in the "Compatible with SM and other Lectrosonics Transmitters" section shows a compatible wiring that will work with all 5-Pin Lectrosonics transmitters. This wiring converts the three-wire microphone to a two wire system without changing the audio quality. (The microphone polarity will be reversed so you may want to enable the phase switch on the Lectrosonics receiver.) This wiring is electrically equivalent to the easy wiring in the "Works with SM only" section.
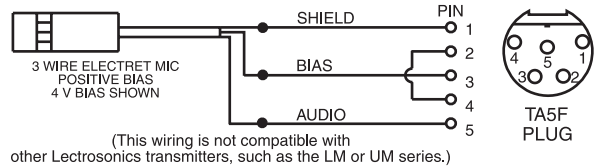
All two-wire mics (except the Countryman B6 and E6) such as the MKE-2 and the Lectro M152 will work with the SM with no changes. The two wire setup is shown in the third diagram in the "Compatible with SM and other Lectrosonics Transmitters" section.

## Works with SM Only:

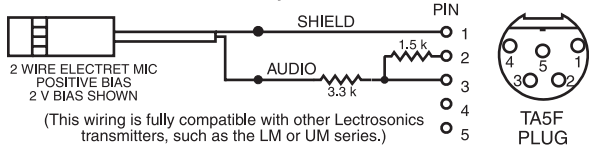**Easy Configuration for
COUNTRYMAN E6 Headphone and B6 Lavaliere Mics**

2 WIRE ELECTRET MIC
POSITIVE BIAS
2 V BIAS SHOWN

SHIELD

AUDIO

PIN 1 2 3 4 5

TA5F PLUG

(This wiring is not compatible with other Lectrosonics transmitters, such as the LM or UM series.)

**Easy Configuration for 3-wire Lavaliere Microphones**

3 WIRE ELECTRET MIC
POSITIVE BIAS
4 V BIAS SHOWN

SHIELD

BIAS

AUDIO

PIN 1 2 3 4 5

TA5F PLUG

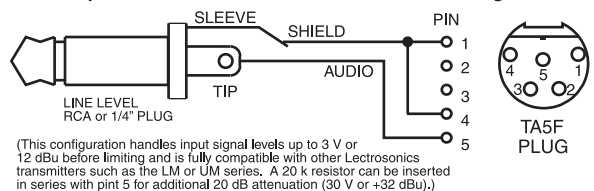(This wiring is not compatible with other Lectrosonics transmitters, such as the LM or UM series.)

## Compatible with SM and other Lectrosonics Transmitters:

**Compatible Configuration for
COUNTRYMAN E6 Headphone and B6 Lavaliere Mics**

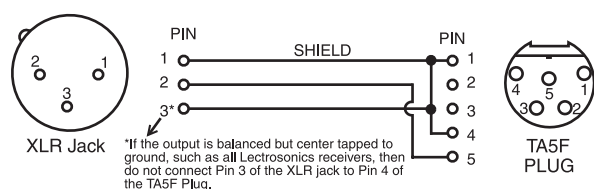2 WIRE ELECTRET MIC
POSITIVE BIAS
2 V BIAS SHOWN

SHIELD

AUDIO

1.5 k

3.3 k

PIN 1 2 3 4 5

TA5F PLUG

(This wiring is fully compatible with other Lectrosonics transmitters, such as the LM or UM series.)

**Compatible Standard Unbalanced Line Level Wiring**

LINE LEVEL
RCA or 1/4" PLUG

SLEEVE

TIP

SHIELD

AUDIO

PIN 1 2 3 4 5

TA5F PLUG

(This configuration handles input signal levels up to 3 V or 12 dBu before limiting and is fully compatible with other Lectrosonics transmitters such as the LM or UM series. A 20 k resistor can be inserted in series with pint 5 for additional 20 dB attenuation (30 V or +32 dBu).)

**Compatible Configuration for 3-wire Lavaliere Microphones That
Require an External Resistor (such as Cos-11)**

3 WIRE ELECTRET MIC
POSITIVE BIAS
4 V BIAS SHOWN

SHIELD

BIAS

3.3 k   AUDIO

PIN 1 2 3 4 5

TA5F PLUG

(This wiring is fully compatible with other Lectrosonics transmitters, such as the LM or UM series. This is the wiring for the Lectrosonics M152 lavaliere.)
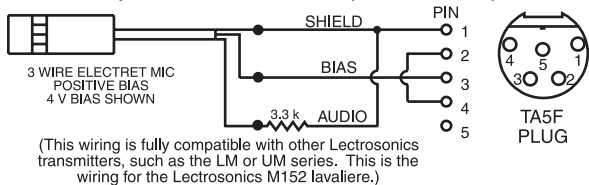
**Compatible Standard Balanced and Floating Line Level Wiring**

XLR Jack

2 1 3

PIN 1 2 3*

SHIELD

PIN 1 2 3 4 5

TA5F PLUG

*If the output is balanced but center tapped to ground, such as all Lectrosonics receivers, then do not connect Pin 3 of the XLR jack to Pin 4 of the TA5F Plug.

**Compatible Configuration for 2-wire Lavaliere Microphones That
Operate Well with 4 Volts of Bias**

2 WIRE ELECTRET MIC
POSITIVE BIAS
4 V BIAS SHOWN

SHIELD

AUDIO

PIN 1 2 3 4 5

TA5F PLUG

(Most common type of lavaliere wiring. This wiring is fully compatible with other Lectrosonics transmitters, such as the LM or UM series.)
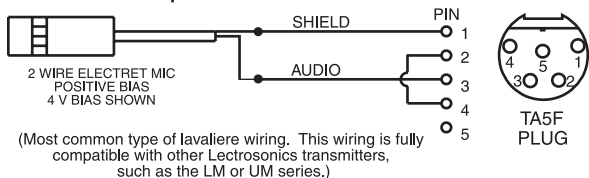
**Compatible LO Z Microphone Input Wiring**

DYNAMIC
MIC LEVEL

2 1 3

PIN 1 2 3

SHIELD

PIN 1 2 3 4 5

TA5F PLUG

Dynamic LO Z mic or electret with manufacturer's power supply.
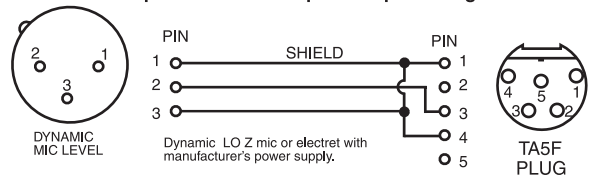
# Troubleshooting

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 PWR LED OFF**
    1) Battery is inserted backwards or dead.

    2) Transmitter not powered up. (See *Operating Instructions, Power UP and Boot Sequence*.)

**TRANSMITTER PWR LED BLINKS GREEN EVERY FEW SECONDS, TRANSMITTER**
**DOES NOT RESPOND OTHERWISE**
    1) Transmitter has been put to sleep by the remote control. Either use the remote control to wake it up again or remove and reinsert the transmitter's battery.

**NO TRANSMITTER MODULATION LEDs**
    1) Gain control set to minimum.

    2) Battery is dead or installed backwards. Check PWR LED.

    3) Mic capsule is damaged or malfunctioning.

    4) Mic cable damaged or mis-wired.

**RECEIVER RF INDICATOR OFF**
    1) Transmitter not turned on, or is in Standby Mode.

    2) Transmitter battery is dead.

    3) Receiver antenna missing or improperly positioned.

    4) Transmitter and receiver not on same frequency. Check switches/display on transmitter and receiver.

    5) Transmitter and receiver not on same frequency block.

    6) Operating range is too great.

    7) Defective transmitter antenna.

**NO SOUND (OR LOW SOUND LEVEL), RECEIVER INDICATES PROPER AUDIO MODULATION**
    1) Receiver output level set too low.

    2) Receiver output disconnected, or cable defective or mis-wired.

    3) Sound system or recorder input is turned down.

**DISTORTED SOUND**
    1) Transmitter gain (audio level) is far too high. Check SM Modulation LEDs and receiver audio levels as SM is being used.

    2) Receiver output may be mis-matched with the sound system or recorder input. Adjust output level on receiver to the correct level for the recorder, mixer or sound system. (Use the receiver's Tone function to check level.)

    3) Excessive wind noise or breath "pops." Reposition microphone and/or use a larger windscreen.

    4) Transmitter is not set to same frequency as receiver. Check that operating frequency on receiver and transmitter match.

    5) Receiver/Transmitter Compatibility Mode mismatched.

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| **SYMPTOM** | **POSSIBLE CAUSE** |
|---|---|

**HISS AND NOISE -- AUDIBLE DROPOUTS**

1) Transmitter gain (audio level) far too low.

2) Receiver antenna missing or obstructed.

3) Transmitter antenna missing.

4) Operating range too great.

5) Signal interference. Turn off transmitter. If receiver's signal strength indicator does not drop to nearly zero, this indicates an interferring signal may be the problem.
Try a different operating frequency.

**EXCESSIVE FEEDBACK**

1) Transmitter gain (audio level) too high. Check gain adjustment and/or reduce receiver output level.

2) Talent standing too close to speaker system.

3) Mic is too far from user's mouth.

**"Loc" APPEARS IN DISPLAY WHEN ANY BUTTON IS PRESSED**

1) Control Panel is locked. (See *Operating Instructions, Locking and Unlocking the Control Panel.*)

**"Hold" APPEARS IN DISPLAY WHEN ARROW BUTTONS ARE PRESSED**

1) Reminder that it is necessary to hold down the AUDIO or FREQ button while adjusting the audio gain or frequency settings.

**"PLL" APPEARS IN DISPLAY**

1) Indication that the PLL is not locked. This is a serious condition that requires factory repair. It may be possible to operate on another frequency far removed from the one that was selected when the unlocked condition was indicated.

**TRANSMITTER WON'T RESPOND TO REMOTE CONTROL**

1. If LCD blinks "rc oFF", transmitter has not be configured to respond to the remote control. See "Remote Control Operation" on page 9 for instructions on how to configure.

2. If LCD blinks "- - - - - -", transmitter is already set as requested by the remote control.

3. If transmitter doesn't not respond at all, try moving the remote control closer to the microphone or increasing the remote control's loudness setting.

4. Be sure the transmitter has firmware v1.5 or newer (see section on Power On Boot Sequence).

# Specifications and Features

**Operating frequencies:**

Block 21  537.600 - 563.100

Block 22  563.200 - 588.700

Block 23  588.800 - 607.900 and 614.100 - 614.300

Block 24  614.400 - 639.900

Block 25  640.000 - 665.500

Block 26  665.600 - 691.100

Block 27  691.200 - 716.700

Block 28  716.800 - 742.300

Block 29  742.400 - 767.900

Block 30  768.000 - 793.500

Block 31  793.600 - 819.100

Block 32  819.200 - 844.700

Block 33  844.800 - 865.000

Block 37  944.100 - 951.900

(Not all frequencies are usable in some countries)

| | |
|---|---|
| **Frequency range:** | 256 frequencies in 100 kHz steps for one 25.5 MHz wide block |
| **Channel Spacing:** | 100 kHz |
| **Frequency selection:** | Control panel mounted membrane switches |
| **RF Power output:** | SM:   100 mW (nominal) |
| | SMD: 100 mW (nominal) |
| | SMQ: 250 mW (nominal) |
| **Compatibility Modes (6)** | Digital Hybrid Wireless™ (400 Series), 200 Series, 100 Series, Mode 3 (other analog), Mode 6, and IFB |
| **Pilot tone:** | 25 to 32 kHz; 5 kHz deviation (in 400 Series Mode) |
| **Frequency stability:** | ± 0.002% |
| **Deviation:** | ± 75 kHz max. (in 400 Series Mode) |
| **Spurious radiation:** | 60 dB below carrier |
| **Equivalent input noise:** | −125 dBV, A-weighted |

**Input level:**

| | |
|---|---|
| **If set for dynamic mic:** | 0.5 mV to 50 mV before limiting. Greater than 1 V with limiting. |
| **If set for electret lavaliere mic:** | 1.7 uA to 170 uA before limiting. Greater than 5000 uA (5 mA) with limiting. |
| **Line level input:** | 5.0 mV to 6 V before limiting. Greater than 15 V with limiting. |

**Input impedance:**

| | |
|---|---|
| **Dynamic mic:** | 300 Ohms |
| **Electret lavaliere:** | Input is virtual ground with servo adjusted constant current bias |
| **Line level:** | 2.7 k Ohms |
| **Input limiter:** | Soft limiter, 30 dB range |
| **Bias voltages:** | Fixed 5 V at up to 5 mA |
| | Selectable 2 V or 4 V servo bias for any electret lavaliere. |
| **Gain control range:** | 40 dB; panel mounted membrane switches |
| **Modulation indicators:** | Dual bicolor LEDs indicate modulation of –20, -10, 0, +10 dB referenced to full modulation. |
| **Low frequency roll-off:** | −18 dB/octave; 70 Hz |
| **Controls:** | Control panel with LCD and four membrane switches. |
| **Audio Frequency Response:** | 35 Hz to 20 kHz, +/-1 dB  *(The audio is deliberately rolled off at 70 Hz using a 18 dB/octave filter. This filter cannot be disabled.)* |

**Signal to Noise Ratio (dB):**
**(overall system, 400 Series mode)**

| SmartNR | No Limiting | w/Limiting |
|---|---|---|
| OFF | 103.5 | 108.5 |
| NORMAL | 107.0 | 111.5 |
| FULL | 108.5 | 113.0 |

Note: The dual envelope "soft" limiter provides exceptionally good handling of transients using variable attack and release time constants. Once activated, the limiter compresses 30+ dB of transmitter input range into 4.5 dB of receiver output range, thus reducing the measured figure for *SNR without limiting* by 4.5 dB

| | | |
|---|---|---|
| **Total Harmonic Distortion:** | | 0.2% typical (400 Series mode) |
| **Audio Input Jack:** | | Switchcraft 5-pin locking (TA5F) |
| **Antenna:** | | Flexible, unbreakable steel cable. |
| **Batteries:** | | 1.5 Volt AA lithium or NiMH recommended |
| **Battery Life:** | SM: | 1.5 hours (alkaline); 5.5 hours (lithium), 4 hours with 2500 mAh NiMH |
| | SMD: | 5.75 hours (alkaline); 14.25 hours (lithium), 8.5 hours with 2500 mAh NiMH |
| | SMQ: | 1.75 hours (alkaline); 7.5 hours (lithium), 5 hours with 2500 mAh NiMH |
| **Weight:** | SM: | 2.7 oz.. (75.9 grams) with lithium battery |
| | SMD/Q: | 3.7 oz.. (105 grams) with lithium batteries |
| **Overall Dimensions:** | | |
| | SM: | 2.3 x 1.8 x 0.64 inches (not including microphone) 58 x 46 x 16 mm (not including microphone) |
| | SMD/Q: | 2.3 x 2.4 x 0.64 inches (not including microphone) 58 x 60 x 16 mm (not including microphone) |

**Emission Designator:**  180KFE3

Specifications subject to change without notice.

The FCC requires that the following statement be included in this manual:

This device complies with FCC radiation exposure limits as set forth for an uncontrolled environment. This device should be installed and operated so that its antenna(s) are not co-located or operating in conjunction with any other antenna or transmitter.

For body worn operation, this SM Belt-Pack Transmitter has been tested and meets the FCC RF exposure guidelines when used with the Lectrosonics accessories supplied or designated for this product.  Use of other accessories may not ensure compliance with FCC RF exposure guidelines.  Contact Lectrosonics if you have any questions or need more information about RF exposure using this product.

# 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 the interconnecting cables and then go through the TROUBLESHOOTING section in this 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

For timely service, please 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 A.M. to 4 P.M. (U.S. 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:**
Lectrosonics, Inc.
581 Laser Rd.
Rio Rancho, NM  87124
USA

**Telephone:**
(505) 892-4501
(800) 821-1121 Toll-free
(505) 892-6243 Fax

**Web:**
www.lectrosonics.com

**E-mail:**
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.