INSTRUCTION MANUAL

HM

Plug-On Transmitter

With Digital Hybrid Wireless® Technology

Digital Hybrid Wireless®
US Patent 7,225,135

Fill in for your records:

Serial Number:

Purchase Date:

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

Thank you for selecting a Lectrosonics HM plug-On transmitter. The unique design provides several distinct features for professional applications:

- Outstanding RF operating range
- Superb audio quality
- Corrosion-resistant housing
- Programmable compatibility modes for use with a wide variety of different receivers

The Digital Hybrid Wireless® design (US Patent 7,225,135) combines 24-bit digital audio with analog FM resulting in a system that has the same operating range as analog systems, the same spectral efficiency as analog systems, the same long battery life as analog systems, plus the excellent audio fidelity typical of pure digital systems.

The HM transmitter uses a standard 3-pin XLR input jack for use with any microphone with a a mating XLR connector. An LCD, membrane switches and multi-color LEDs on the control panel make input gain adjustments and frequency and compatibility mode selection quick and accurate, without having to view the receiver. The battery compartment accepts AA lithium or rechargeable batteries. The HM is machined from a solid aluminum block to provide a lightweight and rugged package. A special non-corrosive finish resists salt water exposure and perspiration in extreme environments.

The DSP-based design works with all Digital Hybrid receivers, and is backward compatible for use with Lectrosonics 200 and 100 Series and IFB receivers and some other brands of analog wireless receivers. Companion receivers are covered in separate manuals.

Table of Contents

General Technical Description 4
Wideband Design 4
Digital Hybrid Wireless® Technology 4
No Pre-Emphasis/De-Emphasis 4
Low Frequency Roll-Off 4
Input Limiter 5
Signal Encoding and Pilot Tone 5
Microprocessor and DSP 5
Compatibility Modes 5
Control Panel 5
Wide-Band Deviation 5
Battery Options and Operating Time 5
Frequency Blocks 5
RF Isolator 5
Controls and Functions 6
LCD Screen 6
Power LED 6
Audio Input Jack 6
Battery Compartment 6
Modulation LEDs 6
Audio Button 6
Freq Button 6
Up/Down Arrows 6
Antenna 6
Battery Installation 7
Attaching/Removing a Microphone 7
Operating Instructions 8
Power Up and Boot Sequence 8
Power Down 8
Automatic Power Restore 8
Standby Mode 8
Compatibility Mode Screen 8
Selecting the Audio Polarity 8
LCD Backlight Settings 9
Selecting Step Size mode 9
Setting Transmitter Operating Frequency 9
Lock/Unlock Screen 9
Audio Screen 9
Adjusting the Input Gain 10
Adjusting the Low Frequency Roll-off 10
Selecting the Phantom Power Supply 10
About the Phantom Power Supply 11
Using the Polarity-Reversing Barrel Adapter 12
Accessories 13
Troubleshooting 14
Specifications and Features 16
Service and Repair 17
Returning Units for Repair 17

General Technical Description

Wideband Design

The HM transmitter uses ±75 kHz wide deviation for an excellent signal to noise ratio and wide dynamic range. The DSP controlled input limiter features a wide range dual envelope design which cleanly limits input signal peaks over 30 dB above full modulation. Switching power supplies to provide constant voltages to the transmitter circuits from the beginning (3 Volts) to the end (1.7 Volts) of battery life, and an ultra low noise input amplifier for quiet operation.

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.

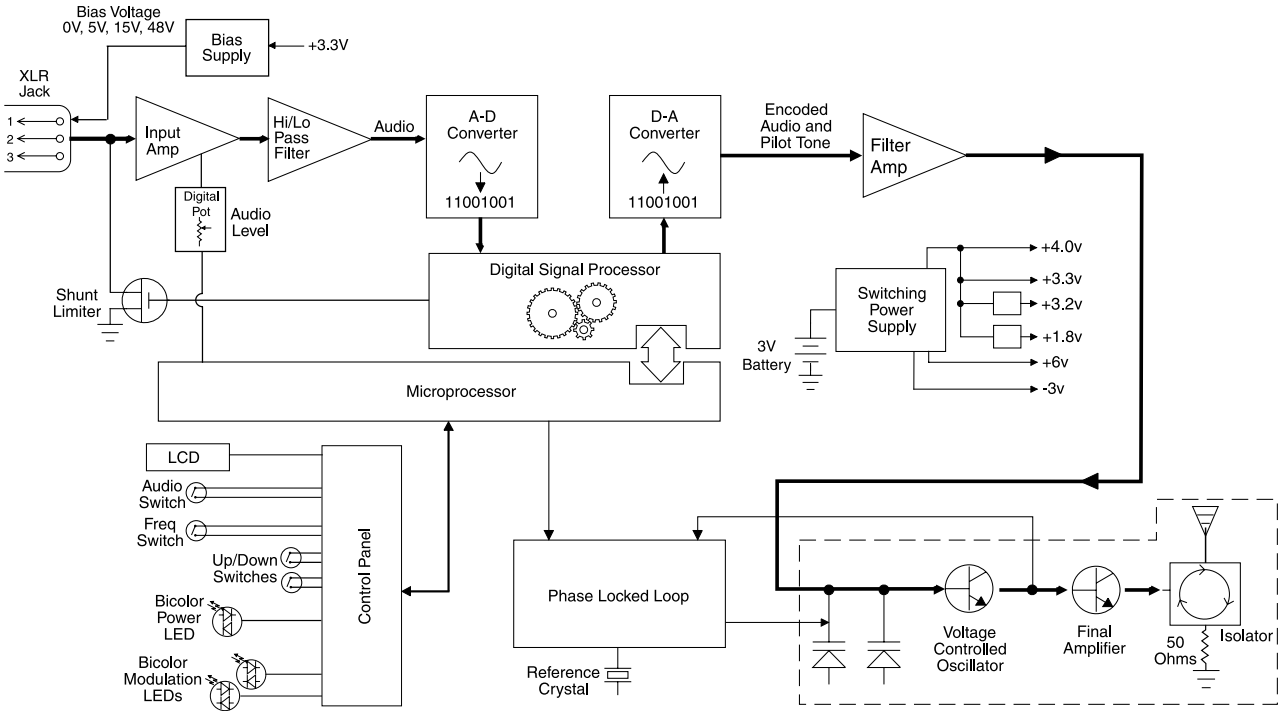
No Pre-Emphasis/De-Emphasis

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. This eliminates the potential for extreme distortion on signals with abundant high-frequency information.

Low Frequency Roll-Off

The low frequency roll-off can be set for a 3 dB down point at 35, 50 or 70 Hz to control subsonic and very low frequency audio content in the audio. The actual roll-off frequency will vary slightly depending upon the low frequency response of the microphone.

Excessive low frequency content can drive the transmitter into limiting, or in the case of high level sound systems, can even cause damage to loudspeaker systems. The roll-off is normally adjusted by ear while listening as the system is operating.



Input Limiter

A DSP-controlled analog audio limiter is employed before the analog-to-digital (A-D) 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, a fast attack and release limiter followed by a slow attack and release limiter. The limiter recovers quickly from brief transients, with no audible side effects, and also recovers slowly from sustained high levels, to keep audio distortion low and while preserving short term dynamics.

Signal Encoding and Pilot Tone

In addition to controlling the limiter, the DSP also encodes the digitized audio from the A-D converter and adds an ultrasonic pilot tone to control the receiver's squelch. A pilot tone squelch system provides a reliable method of keeping a receiver output muted (squelched) even in the presence of significant interference. When the system is operating in the hybrid mode, a different pilot tone frequency is generated for each carrier frequency to prevent inadvertent squelch problems and simplify multi-channel coordination.

Microprocessor and DSP

A 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 that the correct pilot tone is added to the encoded signal.

Compatibility Modes

The HM transmitter was designed to operate with Lectrosonics Digital Hybrid receivers and will yield the best performance when doing so. However, due to the flexibility of digital signal processing, the transmitters can also operate in various compatibility modes for use with Lectrosonics 100 and 200 Series and IFB receivers. It will also work with certain non-Lectrosonics receivers. Contact your sales representative or the factory for a complete list of compatible non-Lectrosonics receivers.

Control Panel

The control panel includes four membrane switches and an LCD screen to adjust the operational settings. Multicolor LEDs are used to indicate audio signal levels for accurate gain adjustment and for battery status.

Wide-Band Deviation

±75 kHz deviation improves the signal to noise ratio and audio dynamic range of a wireless system dramatically, compared to other designs that use ±30 kHz to 40 kHz deviation. Wide deviation combined with a high powered transmitters makes a significant improvement in signal to noise ratio and operating range.

Battery Options and Operating Time

Switching power supplies convert battery voltages to operate various circuit stages with maximum efficiency. With the variety of alkaline, lithium and rechargeable NiMH batteries available today in the AA format, there are many choices to maximize operating time or minimize cost as needed for any application.

Frequency Blocks

Lectrosonics established a "block" numbering system years ago to organize the range of frequencies available from the low 500 MHz band to the upper 700 MHz band. Each block includes 256 frequencies in 100 kHz increments. The block number is part of a simple formula to derive the frequency. The block number is multiplied by 25.6 to produce the lowest frequency in the block. For example, block 27 x 25.6 = 691.200.

RF Isolator

The RF output circuit includes an expensive, special device called an ***isolator*** to significantly reduce IM (intermodulation) that occurs when two transmitters are operated in close proximity to one another. The device is located between the final amplifier and the antenna. (the antenna in the HM plug-on transmitter is formed between the housing and the attached microphone). External RF signals that enter the antenna are routed to a load and do not travel backward into the amplifier. The isolator also provides additional RF output stage protection against static shock.

Controls and Functions

LCD Screen

The LCD is a numeric-type Liquid Crystal Display with several screens that allow settings to be made with the AUDIO, FREQ, UP and DOWN to configure the transmitter. Turn on and turn off countdowns appear in the LCD allowing the transmitter to be turned on for adjustments without the output stage enabled, and to prevent accidental turn off.

Power LED

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

> Note: NiMH batteries will give little or no warning when depleted. If you wish to use NiMH batteries in the HM, 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 Digital Hybrid 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.

Audio Input Jack

The XLR input jack on the HM Series transmitters accommodates most hand-held microphones.

Battery Compartment

The Battery Compartment Cover Plate slides open, allowing access to the battery compartment.

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. 0 dB in the table below indicates full modulation.

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

Audio Button

The AUDIO button is used to display the audio level setting, low frequency roll-off and phantom power mode. Repeatedly pressing the button will cycle through the available settings, allowing the UP and DOWN arrow buttons to adjust the values.

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 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. Frequencies can be selected in either 100kHz or 25kHz steps. The appearance of the hexadecimal number is different in the 100kHz step size mode than in the 25kHz step size mode.

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.

Antenna

An antenna is formed between the housing and the attached microphone, operating much like a dipole type. At UHF frequencies the length of the housing is similar to 1/4 wavelength of the operating frequency, so the antenna is surprisingly efficient, which helps extend the operating range and suppress noise and interference.

Battery Installation

The HM transmitter is powered by two AA batteries. We recommend using lithium batteries for longest life. Lithium batteries provide over 12 hours of operation at room temperature.

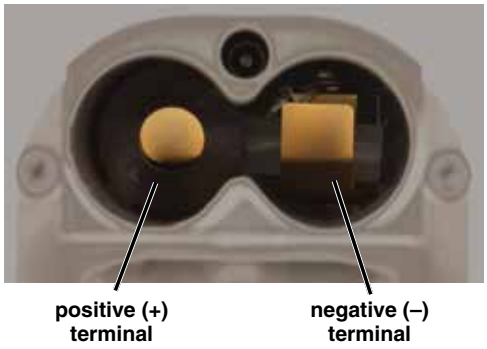
Note: Standard zinc-carbon batteries marked **"heavy-duty"** or **"long-lasting"** are not adequate.

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

Batteries operate in series, with a connecting plate built into the battery door

To install new batteries:

1. Slide open the Battery Cover and remove any old batteries.
2. Insert the new batteries into the housing. One battery goes in positive (+) end first, the other negative (-) end first. Look into the battery compartment to determine which end goes in which side. The side with the plastic ring is the side which accepts the positive end of the battery.



Note: It is possible to install the batteries backward and close the battery door, but the batteries will not make contact and the unit will not work.

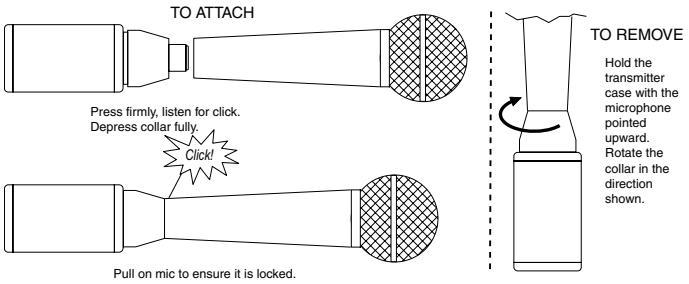
3. Slide the Battery Cover until it snaps securely shut.

Attaching/Removing a Microphone

The spring loaded coupler under the XLR jack maintains a secure fit to the microphone jack with continuous pressure applied by an internal spring.

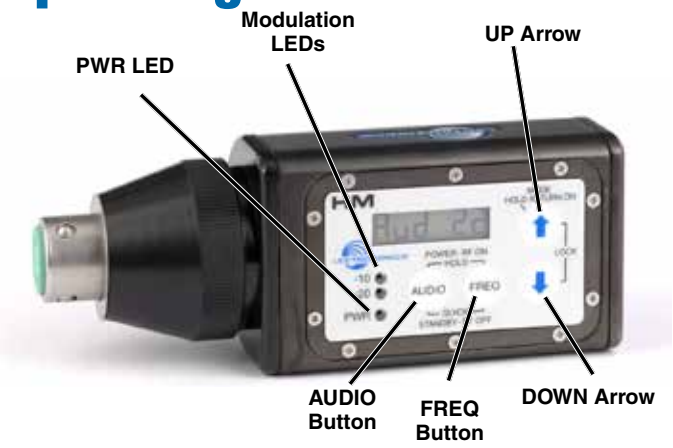
To attach the microphone, simply align the XLR pins and press the microphone onto the transmitter until the coupler retracts and latches. A click sound will be heard as the connector latches.

To remove the microphone, hold the transmitter body in one hand with the microphone pointing upward. Use your other hand to rotate the coupler until the latch releases and the coupler rises slightly.



NOTE: Do not hold or apply any pressure to the microphone body while trying to remove it, as this may prevent the latch from releasing.

Operating Instructions



Power Up and Boot Sequence

1) Ensure that good batteries are installed in the unit.

2) Simultaneously press and hold the AUDIO and FREQ buttons. Continue holding the buttons until ***On*** and the characters ***1, 2, 3*** have appeared. The boot sequence will then initiate.

Initial Power On Timer Screen

As the unit turns on, the Modulation LEDs and PWR LED all glow red, then green, and then they revert to normal operation.

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)

Power Down

Simultaneously press and hold the AUDIO and FREQ buttons. Continue holding the buttons until ***OFF*** and the countdown characters ***3, 2, 1*** have appeared. The unit will then power down.

Initial Power Off Timer Screen

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 LCD will return to the previous screen.

NOTE: If batteries are removed or reach the end of life while the unit is turned on, the unit will turn back on with a brief, simultaneous press of the AUDIO and FREQ buttons. The counting sequence will not be displayed in this instance.

Automatic Power Restore

The firmware will remember the power on/off state and the settings when batteries reach their end of life or are removed. When fresh batteries are installed, the unit will reboot and return to the previous settings without the need to press any buttons. This only works when the unit is fully on and transmitting. ***It does not work in the Standby Mode.***

Standby Mode

Standby Screen

Standby Mode allows you to verify or change the transmitter's operating frequency or audio input level without transmitting a signal. Quickly press and release both the AUDIO and FREQ buttons simultaneously to enter and exit this mode. The characters ***rF OFF*** will appear on the LCD while the unit is in the standby mode.

Compatibility Mode Screen

Hold down the UP arrow button while powering up the unit to enter the Compatibility Mode screen. Use the UP or DOWN arrow buttons to select one of six compatibility modes:

Note: RF transmission is prevented while selecting Compatibility Modes. Also, the HM exits this screen to the Standby Mode.

- 400 - For Digital Hybrid Wireless® receivers.
- 200 - For Lectrosonics 200 Series receivers.
- 100 - For Lectrosonics 100 Series receivers.
- 3 - (Mode 3) For non-Lectrosonics analog receivers. Contact the the factory for details.
- IFB - For Lectrosonics IFB receivers.
- 6 - (Mode 6) For non-Lectrosonics analog receivers. Contact the factory for details.

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 and hold AUDIO and FREQ together.

Selecting the Audio Polarity

The character *P* denotes "positive" polarity and the character *n* denotes "negative" polarity.

Hold the UP arrow in and press the AUDIO and FREQ buttons together to enter the setup mode. The display will first enter the ***CP*** (compatibility mode) setup screen.

Press either the AUDIO or FREQ button to enter the ***AP*** (audio polarity) setup screen. Use the UP and DOWN arrows to select the desired polarity.

NOTE: The audio polarity can also be reversed at the output of most Lectrosonics receivers.

LCD Backlight Settings

The LCD backlight can be set to turn off after either 5 minutes or 30 seconds or stay on continuously. Hold the UP arrow in while powering up the unit to enter the setup screen. Press the AUDIO button repeatedly to step through the setup items to reach the backlight settings screen. Use the UP or DOWN arrow button to select the desired setting.

Selecting Step Size mode

Hold the UP arrow in while powering up the unit to enter the setup screen. Press the AUDIO button repeatedly to step through the setup items to reach the Step Size Mode screen. Use the UP or DOWN arrow button to select the desired setting.

Setting Transmitter Operating Frequency

1) If the LCD is displaying something other than the Frequency Screen, press the FREQ button on the HM 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 to legacy Lectrosonics products that used two 16-positon switches to set the frequency.

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 th upper end.

Set Up in 100kHz Mode

Frequency displayed in MHz

Frequency displayed as two-digit hexadecimal number

The operating frequency of the HM can be displayed either in MHz or as a two-digit hexadecimal number. The example of the two-digit display shown here indicates ***CH*** (channel) and ***2C*** as the frequency.

The frequency can be set with the unit in standby mode or when powered up for normal operation.

Set Up in 25kHz Mode

The hexidecimal display in the 25 kHz mode will appear with a decimal suffix to indicate the 25 kHz steps.

644.400 MHz

644.425 MHz

644.450 MHz

644.475 MHz

Lock/Unlock Screen

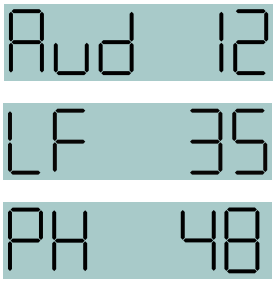
Simultaneously pressing and holding both the UP and DOWN arrow buttons during normal operation starts the Lock timer. The timer starts at three and counts down to zero. When the timer reaches zero, the transmitter's controls are locked.

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.

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 an on-screen ***Loc*** reminder that the controls are locked. Remove the batteries to unlock the control panel.

Important: Once the transmitter is locked, it cannot be unlocked or powered off using the buttons. The only way to unlock a locked transmitter is to remove the batteries.

Audio Screen



The Audio Screen is used to adjust input gain and low frequency roll-off, and to turn phantom power on and off. Repeatedly pressing the AUDIO button selects the setting. Press and hold the AUDIO button and use the UP and DOWN arrows to adjust the value.

Adjusting the Input Gain

The control panel Modulation LEDs indicate the modulation level and limiter activity. This gain adjustment matches the transmitter gain with the microphone's output level, the user's voice level and the position of the microphone. Once set, the transmitter's audio level setting ***should not*** be used to control the volume of your sound system or recorder levels. The audio input level can be set with the unit in Standby Mode or while powered up in 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: Voice levels vary significantly between different people. 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 HM powered off, insert the microphone plug into the XLR Input Jack, aligning the pins and ensuring that the connector locks.

2) Place the transmitter in the 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.

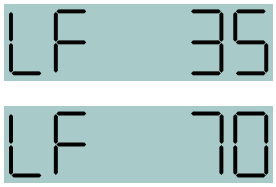
4) Observe the audio level LEDs while speaking or singing into the microphone at the same voice level that will be used during use. While holding the AUDIO button, press the UP or DOWN arrows until the both the -20 and -10 LEDs glow green, with the -20 LED flickering red on louder peaks. This will optimize the signal to noise ratio of the system with full modulation and adequate headroom to prevent overload and audible compression of signal peaks.

Note: Setting the audio level too high reduces the dynamic range of 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 turn the transmitter off, then power it up again in normal operation so the RF output will be on. Then the other components in the sound or recording system can be adjusted.

Adjusting the Low Frequency Roll-off

Repeatedly press the AUDIO button until the LF roll-off adjustment screen appears. Then press and hold the AUDIO button while selecting the desired roll-off frequency with the UP and DOWN arrows.



The roll-off frequency can be set to 35, 50 or 70 Hz.

Selecting the Phantom Power Supply

With the HM transmitter powered on and in the normal or standby mode, press and hold the audio button and observe the LCD. Release the button and press and hold it again. Repeat this process until the display indicates the ***PH*** (phantom mode0.

Once you get to the ***PH*** setting, keep the ***AUDIO*** button pressed, then use the UP and DOWN arrow keys to cycle through the available settings (off, 5, 15, 48 volts) until the desired setting is displayed.

When you release the ***AUDIO*** button, the setting will be stored to the value you selected.

About the Phantom Power Supply

Three phantom voltages are selectable from the control panel. The voltages are:

- ***5 Volts*** for lavaliere microphones,
- ***15 Volts*** for some professional mics requiring high current and for many common stage mics that will operate over a wide phantom Voltage range of 12 to 48 Volts. With the proper adapter, this position can also be used with T power microphones. See our web site for details on finding or making the proper adapter.
- ***48 Volts*** for microphones that do in fact require a supply greater than 18 Volts. (See below for a discussion of why 42 and not a “true” 48 Volts.)

For longest battery life use the minimum phantom voltage necessary for the microphone. Many stage microphones regulate the 48 Volts down to 10 Volts internally anyway, so you might as well use the 15 Volt setting and save some battery power. If you are not using a microphone for the input device, or are using a microphone that does not require phantom power, turn the phantom power off.

Phantom power should only be used with a fully floating, balanced device such as most microphones with a 3-pin XLR connector. If you use the phantom power with an unbalanced device or if pins 2 or 3 are DC connected to ground, then you will draw maximum current from the power supply. The HM is fully protected against such shorts but the batteries will be drained at twice the normal rate.

The transmitter can supply 4 mA at 42 Volts, 8 mA at 15 Volts, and 8 mA at 5 Volts. The 42 Volts setting actually supplies the same voltage to a 48 Volt microphone as the DIN standard arrangement due to a dynamic biasing scheme that does not have as much voltage drop as the DIN standard. The 48 Volt DIN standard arrangement protects against shorts and high fault current with high resistance in the power supply feeds to pins 2 and 3. This provides protection if the supply current is accidentally shorted to ground and also keeps the microphone from being attenuated by the power supply.

The HM improves on those functions and is able to use less power from the battery by using constant current sources and current limiters. With this dynamic arrangement the HM can also supply more than twice the current of competing 48 Volt plug on units and provide four times the current for some very high end 15 Volt microphones.

Special Purpose Barrel Adapters

21750

Mic adapter for Earthworks M30 microphone with HM or UH400a/TM transmitters.

This polarity reversing adapter may be needed to correct for asymmetrical current draw in some P48 powered condenser microphones, including older Neumann 100 Series, Rode NTG3 and others. If your microphone does not power on correctly when used with a UH400- or HM- transmitter, insert the adapter between the transmitter and microphone.

MCA-M30

This adapter may be needed if you are experiencing noise or distortion with measurement microphones, particularly the Earthworks M30. The adapter has common mode checks for suppressing RF noise. If your microphone signal exhibits the problems listed above when connected to a UH400 or HM-type transmitter, insert the adapter between the microphone and the transmitter.

Insert the adapter between the transmitter and microphone to alleviate the problems listed above.

Accessories

PHTRAN3

Replacement leather pouch with rotating belt clip and snap closure. Included with transmitter at purchase.

MC5AX

Optional adapter for connecting a lavaliere microphone to the HM transmitter. TA5M to XLR3-M connectors. Passes transmitter phantom power to bias the electret lavaliere microphone. Includes zener protection to limit bias voltage to protect the microphone if transmitter phantom power is set too high.

MCA-TPOWER

This cable adapter is to be used with the UH200D, UH400 and HM plug-on transmitters with T-powered microphones. It will protect a T-power mic against the 48V phantom power setting in the transmitter while allowing normal operation. The transmitter should be set to the 15V position for best operation and minimum current drain.

Troubleshooting

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

SYMPTOM	POSSIBLE CAUSE
TRANSMITTER PWR LED OFF	1) Batteries are inserted backwards or dead. 2) Transmitter not powered up. (See *Operating Instructions, Power UP and Boot Sequence.*)
AUDIO LEVEL LEDs NOT LIGHTING	1) Gain control set to minimum. 2) Batteries are inserted backwards or dead. Check PWR LED. 3) Mic capsule is damaged or malfunctioning. 4) Mic connector is damaged or mis-wired.
RECEIVER RF INDICATOR OFF	1) Transmitter not turned on, or is in Standby Mode. 2) Transmitter batteries are 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.
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 HM LEDs and receiver audio levels as HM is being used. 2) Receiver output may be mismatched 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.
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.

SYMPTOM	POSSIBLE CAUSE
HISS AND NOISE -- AUDIBLE DROPOUTS	1) Transmitter gain (audio level) far too low. 2) Receiver antenna missing or obstructed. 3) Operating range too great. 4) Signal interference. Turn off transmitter. If receiver's signal strength indicator does not drop to nearly zero, this indicates an interfering signal may be the problem. Use a clear operating frequency.
"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	Reminder that it is necessary to hold down the AUDIO or FREQ button to make adjustments to the audio gain or frequency settings.
"PLL" APPEARS IN DISPLAY	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.

Specifications and Features

Operating frequencies: (Frequency usage varies by country)

Block 470	470.100 - 495.600
Block 19	486.400 - 511.900
Block 20	512.000 - 537.500
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

Frequency range:
- 256 frequencies in 100 kHz steps
- 1024 frequencies in 25 kHz steps

Channel Spacing: 100 kHz or 25 kHz

Frequency selection: Control panel mounted membrane switches

RF Power output: 100 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 Digital Hybrid 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: 17 mV to 1.7 V before limiting. Greater than 50 V with limiting.

Input impedance: 1K Ohm

Input limiter: Soft limiter, 30 dB range

Gain control range: 55 dB

Modulation indicators: Dual bicolor LEDs indicate modulation of –20, -10, 0, +10 dB referenced to full modulation.

Controls: Control panel with LCD and four membrane switches.

Low frequency roll-off: Selectable; -3dB at 35, 50 or 70 Hz.

Audio Frequency Response: 35 Hz to 20 kHz, +/-1 dB (The low frequency roll-off is adjustable)

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

SmartNR	No Limiting	w/Limiting
OFF	103.5	108.0
NORMAL	107.0	111.5
FULL	108.5	113.0

The dual envelope "soft" limiter provides exceptionally good handling of transients using variable attack and release time constants. The limiter reduces 30 dB of dynamic range into 4.5 dB, which reduces the measured figure for SNR without limiting by 4.5 dB.

Total Harmonic Distortion: 0.2% typical (400 Series mode)

Audio Input Jack: 3-pin Female XLR

Phantom Power: 5V @ 18 mA max., 15V @ 15 mA max. and 48 V @ 4 mA max., plus "OFF"

Antenna: Housing and attached microphone form the antenna

Batteries: Two 1.5 Volt AA lithium or rechargeable NiMH recommended

Battery Life:

AA Batteries	No Phantom*	48V On**
Alkaline	5h 0m	3h 30m
NiMh 2500	9h 15m	7h 0m
Lithium	16h 0m	12h 45m

***Tested with a dynamic microphone**

****Tested with a Sanken CS-1 for a phantom-powered microphone**

Weight: 6.7 oz (190 grams) without batteries

Overall Dimensions: 4.25x1.62x1.38 inches

Emission Designator: 180KF3E

Specifications subject to change without notice.

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

For body worn operation, this HM 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..

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.

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 email 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.

Lectrosonics USA:

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

Lectrosonics Canada:

Mailing Address:
720 Spadina Avenue,
Suite 600
Toronto, Ontario M5S 2T9

Telephone:
(416) 596-2202
(877) 753-2876 Toll-free
(877-7LECTRO)
(416) 596-6648 Fax

E-mail:
Sales: colinb@lectrosonics.com
Service: joeb@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®
581 Laser Road NE • Rio Rancho, NM 87124 USA • www.lectrosonics.com
+1(505) 892-4501 • fax +1(505) 892-6243 • (800) 821-1121 US and Canada • sales@lectrosonics.com

3 June 2020