

# Digital Hybrid Wireless® Watertight Belt-Pack Transmitter

WM, WM/E01, WM/E02, WM/X



Designed for wet or dusty environments, the WM transmitter features O-ring sealed battery compartments and input jack, a compression sealed antenna port, and gasket sealed control panel and back cover. Dual AA batteries provide twice the operating time of earlier watertight transmitter designs. Larger membrane switches and control panel and a highly visible, backlit LCD enhance the user interface.

**Digital Hybrid Wireless®** is a revolutionary new design that combines digital audio with an analog FM radio link to provide outstanding audio quality and the exemplary RF performance of the finest analog wireless systems.

This overcomes 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. Instead, it is a technique which can be accomplished only in the digital domain.

The process eliminates compandor artifacts, expanding the applications to include test and measurement of acoustic spaces and musical instruments.

\*US Patent 7,225,135

- Selectable output power (50, 100, 250 mW) to maximize battery life or operating range
- Machined aluminum, corrosion resistant housing
- Water resistant seals for use in wet environments
- LCD interface with lockout option
- Programmable compatibility modes for use with a wide variety of different receivers (varies with model; see Specifications)
- Servo Bias input circuitry with selectable voltage

To meet the demand for both extended operating range and extended battery life, the transmitter offers selectable output power of 50, 100 and 250 mW. With higher power output, the operating range is improved at the expense of battery life. When range is not an issue, the power can be reduced to extend the battery life.

The transmitter can be controlled by the LectroRM app for *hands free* setup and adjustment using audible tones delivered into the microphone from your phone. The transmitter can be put to sleep to conserve battery power during setup when it is buried deep inside costuming, then awakened for normal operation when the production begins. Other adjustments include frequency, audio level and control panel lockout.

The DSP-based design works with all Digital Hybrid receivers, and is backward compatible for use with Lectrosonics Mode 3 and IFB.

The input section features servo bias circuitry with voltages being selectable from the LCD to match the requirements of a wide variety of lavalier microphones. The bias can also be turned off for use with dynamic microphones. A line level setting is provided for use with signal levels up to 5 volts. The low frequency roll-off can be adjusted from 35 to 150 Hz.

A DSP-controlled analog audio limiter is employed ahead of the first mic preamp to protect the entire audio chain from overload. The limiter has a range of more than 30 dB for excellent overload protection and a dual release envelope that makes the limiter acoustically transparent while maintaining low distortion.

## Watertight Connections

The input connector is mounted in a recessed opening which provides a captive seat for the O-ring on the microphone connector. This captures the O-ring allowing it to be tightened firmly.

The antenna is mounted with a compressible strain relief under a flange that presses the strain relief into a tapered opening for a watertight connection.



## 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. The limiter recovers quickly from brief transients, so that its action is hidden from the listener, but recovers slowly

from sustained high levels, to keep audio distortion low and preserve short term dynamic changes.

The bicolor LEDs on the control panel accurately indicate limiter activity to assist in setting the input gain for optimal signal to noise ratio and dynamic range.

## DSP-Based Pilot Tone & Compatibility

The DSP generated pilot tone eliminates the need for fragile crystals and allows a different pilot tone frequency for each of the carrier frequencies in the tuning range of the wireless system. Individual pilot tones significantly reduce squelch problems in multichannel systems where a pilot tone signal can appear in the wrong receiver via intermodulation products.

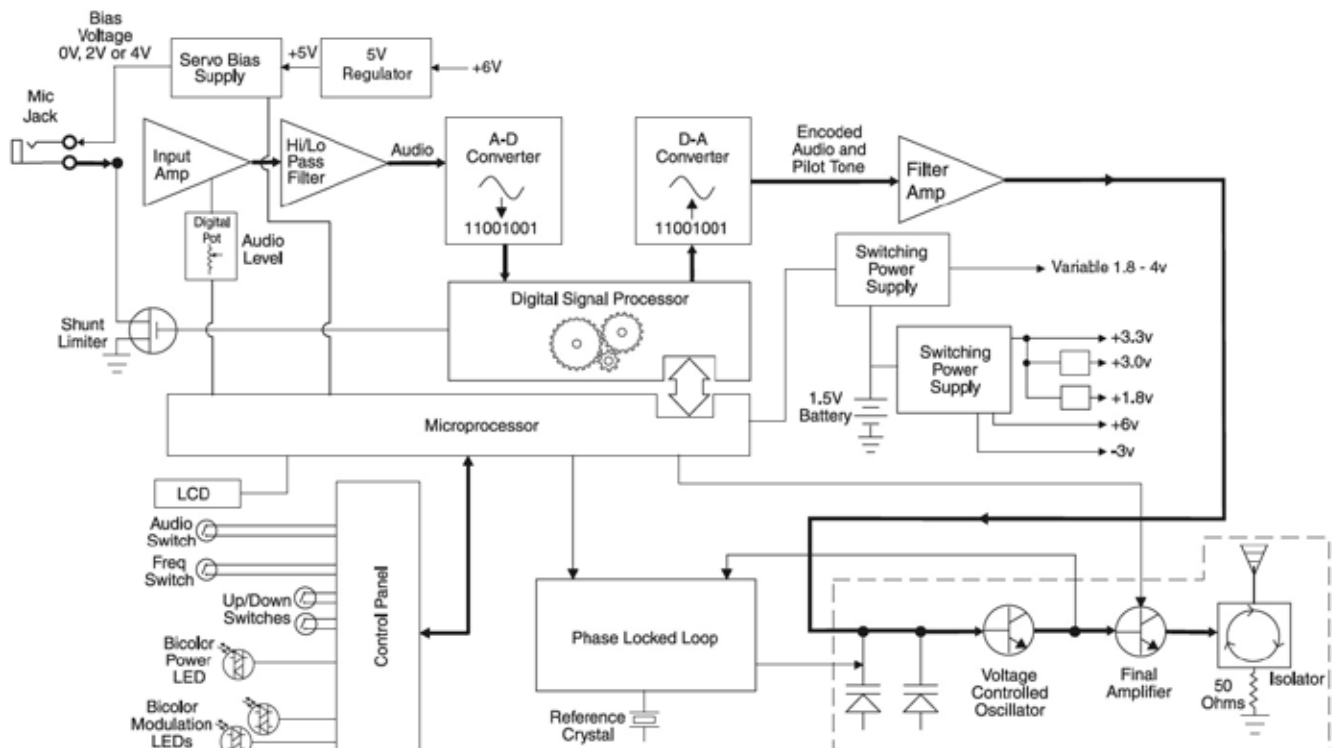
The DSP also offers compatibility modes to allow backward compatibility with all Lectrosonics Mode 3 and IFB systems, in addition to its Nu Hybrid operating mode.

## Output Isolator

The transmitter RF output circuit includes a specialized RF device called an *isolator* using a magnetically polarized ferrite to allow RF signals to pass through to the antenna, but block them from coming backward into the transmitter output section.

The isolator greatly reduces RF intermodulation produced in the transmitter output stages when multiple units are used in close proximity (a few feet apart). The isolator also helps protect the output stage from electrostatic shock delivered to the antenna. Isolators are common in broadcast and commercial applications, but because of their high cost it is unusual to find them in wireless microphone transmitters.

## WM Transmitter Block Diagram



# LectroRM

By New Endian LLC

LectroRM is a mobile application for iOS and Android operating systems. Its purpose is to remotely control Lectrosonics Transmitters, including:

- SM Series
- WM
- L Series

The app remotely changes settings on the transmitter through the use of encoded audio tones, which when received by the attached microphone, will alter the configured setting. The app was released by New Endian, LLC in September 2011. The app is available for download and sells for \$25 on the Apple App Store and Google Play Store.

LectroRM's remote control mechanism is the use of an audio sequence of tones (dweedles) that are interpreted by the transmitter as a configuration change. The settings available in LectroRM are:

- Audio Level
- Frequency
- Sleep Mode
- Lock Mode

## Activation

For a transmitter to respond to remote control audio tones, the transmitter must meet certain requirements:

- The transmitter must not be turned off; it can however be in sleep mode.
- The transmitter must have firmware version 1.5 or later for Audio, Frequency, Sleep and Lock changes.
- The transmitter microphone must be within range.
- The transmitter must be configured to enable remote control activation.

***Please be aware this app is not a Lectrosonics product. It is privately owned and operated by New Endian LLC, [www.newendian.com](http://www.newendian.com).***

## User Interface

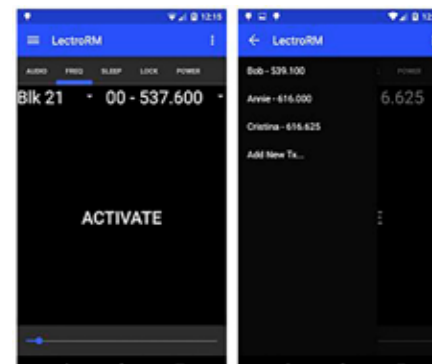
The user interface involves selecting the audio sequence related to the desired change. Each version has an interface for selecting the desired setting and the desired option for that setting. Each version also has a mechanism to prevent accidental activation of the tone.

### iOS



The iPhone version keeps each available setting on a separate page with the list of options for that setting. On iOS, the "Activate" toggle switch must be enabled to show the button which will then activate the audio. The iOS version's default orientation is upside-down but can be configured to orient right-side up. The purpose for this is to orient the device's speaker, which is at the bottom of the device, closer to the transmitter microphone.

### Android



The Android version keeps all settings on the same page and allows the user to toggle between the activation buttons for each setting. The activation button must be long pressed to activate. The Android version also allows users to keep a configurable list of full sets of settings.

# Specifications

## Operating frequencies:

WM:	Block 470	470.100 - 495.600	Block 21	537.600 - 563.100
	Block 19	486.400 - 511.900	Block 22	563.200 - 588.700
	Block 20	512.000 - 537.500	Block 23	588.800 - 614.300
WM/E01:	Block 470	470.100 - 495.600	Block 23	588.800 - 614.300
	Block 19	486.400 - 511.900	Block 606	606.000 - 631.500
	Block 20	512.000 - 537.500	Block 24	614.400 - 639.900
	Block 21	537.600 - 563.100	Block 25	640.000 - 665.500
	Block 22	563.200 - 588.700	Block 26	665.600 - 691.100
WM/E02*:	Block 470	470.100 - 495.600	Block 25	640.000 - 665.500
	Block 19	486.400 - 511.900	Block 26	665.600 - 691.100
	Block 20	512.000 - 537.500	Block 27	691.200 - 716.700
	Block 21	537.600 - 563.100	Block 28:	716.800 - 742.300
	Block 22	563.200 - 588.700	Block 29:	742.400 - 767.900
	Block 23	588.800 - 614.300	Block 30:	768.000 - 793.500
	Block 606	606.000 - 631.500	Block 31:	793.600 - 819.100
	Block 24	614.400 - 639.900	Block 32:	819.200 - 844.700
			Block 33:	844.800 - 861.900

\* Frequency usage varies by country.

WM/X:	Block 470	470.100 - 495.600	Block 23	588.800 - 614.300
	Block 19	486.400 - 511.900	Block 606	606.000 - 631.500
	Block 20	512.000 - 537.500	Block 24	614.400 - 639.900
	Block 21	537.600 - 563.100	Block 25	640.000 - 665.500
	Block 22	563.200 - 588.700	Block 26	665.600 - 691.100

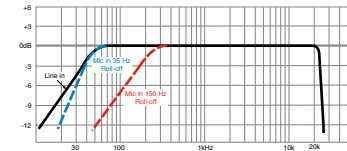
**NOTE: It's the user's responsibility to select the approved frequencies for the region where the transmitter is operating**

<b>Channel Spacing:</b>	WM: 25 kHz or 100 kHz WM/E01: 100 kHz WM/E02: 100 kHz WM/X: 25 kHz or 100 kHz
<b>Frequency selection:</b>	Control panel mounted membrane switches
<b>RF Power output:</b>	WM: Switchable; 50, 100 or 250 mW WM/E01: Switchable; 50, 100 or 250 mW WM/E02: 10 mW WM/X: Switchable; 50, 100 or 250 mW
<b>Compatibility Modes</b>	WM: Nu Hybrid, IFB, Mode 3 WM/E01: Digital Hybrid Wireless® and IFB WM/E02: Digital Hybrid Wireless® and IFB WM/X: Nu Hybrid, Digital Hybrid Wireless®, IFB, Mode 3, Mode 4, Mode 6
<b>Pilot tone:</b>	3.5 kHz deviation (Nu Hybrid) 25 to 32 kHz; 3 kHz deviation (Digital Hybrid Mode)
<b>Frequency stability:</b>	± 0.002%
<b>Spurious radiation:</b>	WM: Compliant with ETSI EN 300 422-1 v1.4.2 WM/E01/E02/E0X: 60 dB below carrier
<b>Equivalent input noise:</b>	-125 dBV, A-weighted
<b>Input level:</b>	
<b>Dynamic mic:</b>	0.5 mV to 50 mV before limiting. Greater than 1 V with limiting.
<b>Electret lavalier mic:</b>	1.7 uA to 170 uA before limiting. Greater than 5000 uA (5 mA) with limiting.
<b>Line level input:</b>	17 mV to 1.7 V before limiting. Greater than 5 V with limiting.

<b>Input impedance:</b>	300 Ohms
<b>Dynamic mic:</b>	Input is virtual ground with servo adjusted constant current bias
<b>Electret lavalier:</b>	> 2.7 k Ohms
<b>Line level:</b>	> 2.7 k Ohms
<b>Input limiter:</b>	Soft limiter, 30 dB range
<b>Bias voltages:</b>	Selectable; 2V, 4V and Off
<b>Gain control range:</b>	44 dB; panel mounted membrane switches
<b>Modulation indicators:</b>	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:** Adjustable from 35 to 150 Hz



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

<b>Signal to Noise Ratio (dB):</b>	SmartNR	No Limiting	w/Limiting
	OFF	103.5	108.0
	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. The gradual onset of limiting in the design begins below full modulation, which reduces the measured figure for SNR without limiting by 4.5 dB)

<b>Total Harmonic Distortion:</b>	0.2% typical (Nu Hybrid mode)
<b>Audio Input Jack:</b>	2.5 mm locking micro; threaded for stainless sleeve on WP connector
<b>Antenna:</b>	Flexible, unbreakable steel cable.
<b>Batteries:</b>	1.5 Volt AA (lithium recommended)

Power Setting:	Battery Life: (HH:MM)
50 mW (2 AA):	13:00
100 mW (2 AA):	10:45
250 mW (2 AA):	5:45

<b>Weight:</b>	5.33 oz. (151 grams) with lithium batteries
<b>Housing Dimensions:</b>	2.98 x 2.55 x 0.77 inches 75.7 x 64.8 x 19.6 mm (including battery caps)
<b>Emission Designator:</b>	WM: 110KF3E WM/E01: 180KF3E

Specifications subject to change without notice.



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