UCR401

TECHNICAL DATA

Digital Hybrid Wireless™ Compact Diversity Receiver

- **Digital Hybrid Wireless™**
- **LCD with spectrum scanner**
- **Two AA Batteries or DC Power**
- **SmartSquelch™ for noiseless muting**
- **256 selectable UHF frequencies**
- **SmartDiversity™ for enhanced RF reception**
- **Compatibility with analog transmitters**
- **DSP-based pilot tone squelch**
- **Balanced XLR output**

The UCR401 is a high performance compact UHF wireless microphone receiver for mobile applications such as ENG and film production. The compact size, battery and external power and rugged attached antennas are ideal for video camera mounted use. Unique DSP algorithms in the design provide full compatibility with all Lectrosonics 400 Series Digital Hybrid Wireless™ transmitters and variety of analog transmitters from Lectrosonics and some other manufacturers. Power is provided by two AA batteries, typically NiMH rechargeable types, or external DC supplied via a jack on the rear panel.

Microprocessor control enables SmartSquelch™ and SmartDiversity™ advanced reception techniques to minimize noise and dropouts in all conditions. The receiver differentiates between close and distant operation and adjusts the squelch threshold automatically. In environments with significant RF reflections, the diversity switching activity optimizes the antenna combining based upon an analysis of RF level and audio content.

Digital Hybrid Wireless™ is a patent-pending, revolutionary new design that combines digital audio with an analog FM radio link to provide outstanding audio quality and the extended operating range of the finest analog wireless systems. The design eliminates a compandor and its artifacts in the audio path.

The design 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, even though the audio inputs and outputs are analog signals.

Finding a clear operating channel is simplified with a choice of 256 frequencies across a 25.6 MHz bandwidth. A built-in RF spectrum analyzer scans the entire tuning range of the receiver and displays RF activity on the built-in LCD. Signal strength of other signals in the vicinity is indicated and empty sections of the spectrum are quickly identified with the graphical display. The analyzer will scan the entire spectrum and display the results in about 25 seconds, so it is very convenient to find a clear frequency in each new location.

The DSP generates a unique pilot tone frequency for each selected operating frequency to simplifiy coordination in multi-channel wireless systems. This eliminates the possibility of a valid pilot tone signal being passed to another receiver via IM (intermodulation) products.

The UCR401 preserves compatibility with earlier Lectrosonics analog wireless transmitters in addition to its native hybrid operating mode. The DSP emlulates a compandor when set for use with 100 or 200 Series, IFB transmitters and can even be used with some models from other manufacturers. When operating in the native hybrid mode with a Lectrosonics hybrid transmitter, there is no compandor in the audio path, so audio quality rivals a hard-wired connection.

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SmartSquelch™

Conventional squelch design faces several compromises:

- Squelch too aggressively and audio may be lost.
- Squelch too little and excessive noise may be heard.
- Respond too rapidly and the audio will sound “choppy.”
- Respond too sluggishly and entire words or syllables can be cut off.

SmartSquelch™ overcomes these problems by:

- Waiting for a complete word or syllable before squelching.
- Assessing recent squelching history and RF signal strength.
- Assessing audio content to determine available masking.

By adjusting squelching behavior dynamically under varying conditions, the UCR401 delivers acceptable audio quality from otherwise unusable signals.

SmartDiversity™

Microprocessor controlled antenna phase combining keeps the receiver small, yet still able to deal effectively with multi-path dropouts. SmartDiversity™ analyzes both the incoming RF level and the RF level’s rate of change to determine the optimum timing for phase switching, and the optimum antenna phase. This adaptive technique operates over a wide range of RF levels to anticipate dropouts before they occur. The system also employs “opportunistic switching” to analyze and then latch the phase in the best position during brief squelch activity.

SmartNR™

In order to increase the effective dynamic range of the system, the UCR401 is equipped with a Smart Noise Reduction algorithm, which removes hiss without sacrificing high frequency response. SmartNR™ works by attenuating only those portions of the audio signal that fit a statistical profile for randomness or “electronic hiss.” SmartNR™ offers significantly increased transparency over the sophisticated variable low pass filters used in previous designs. Desired high frequency signals having some coherence such as speech sibilance and tones are not affected.

DSP-based Pilot Tone

The 400 Series system design uses a DSP generated ultrasonic pilot tone to control the receiver audio muting (squelch). By sensing the pilot tone and incorporating brief delays when the matching transmitter is turned on or off, thumps, pops and other transients are successfully eliminated.

The pilot tone frequency is different for each of the 256 frequencies in the tuning range (frequency block) of a system, which simplifies the coordination of multi-channel wireless systems. The DSP generated pilot tone system also eliminates fragile crystals, allowing the receiver to survive shocks and mishandling much better than older analog-based pilot tone systems.

Compatibility Modes

The UCR401 receiver is designed to operate with Lectrosonics 400 Series transmitters and will yield the best performance when doing so. However, thanks to the flexibility of digital signal processing, the UCR401 can also be used with Lectrosonics IFB, 200 and 100 Series and certain non-Lectrosonics analog transmitters in special compatibility modes.

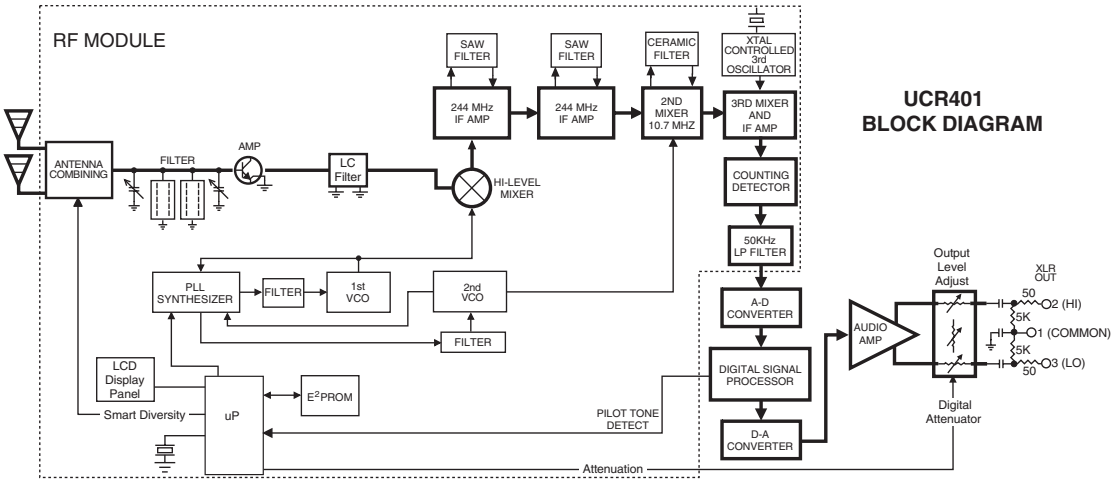
Digital Hybrid Wireless Architecture

The block diagram below outlines the architecture of this Digital Hybrid Wireless* receiver, starting with the front-end filter and ending with a balanced output.

Front-end filters block high powered RF energy on nearby frequencies to protect the receiver from interference from sources like television broadcasts. After this filtering the signal is converted to the final 300 kHz IF frequency through three stages.

A digital pulse counting detector recovers the encoded analog signal sent from the transmitter. This signal is then filtered, converted into a digital bitstream and sent to the DSP. The DSP then recovers the 24-bit digital audio signal that was generated in the transmitter, which is then converted to analog and delivered to the output stage.

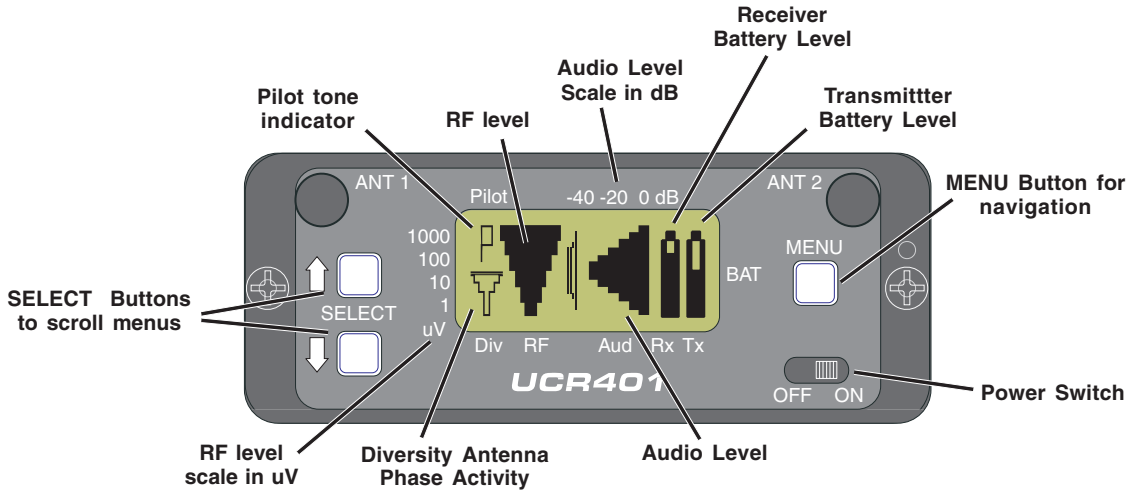
**US Patent Pending*



Front Panel and LCD interface

Graphical icons indicate the status of all aspects of operation, including RF and audio levels, diversity switching activity and the status of batteries in the receiver and the transmitter being operated. Sub-menus and a variety of screens provide access to all settings and adjustments.

The LCD is backlit for visibility in dim lighting conditions and remains very visible in direct sunlight. All menus and screens are accessed with three buttons on the front panel.



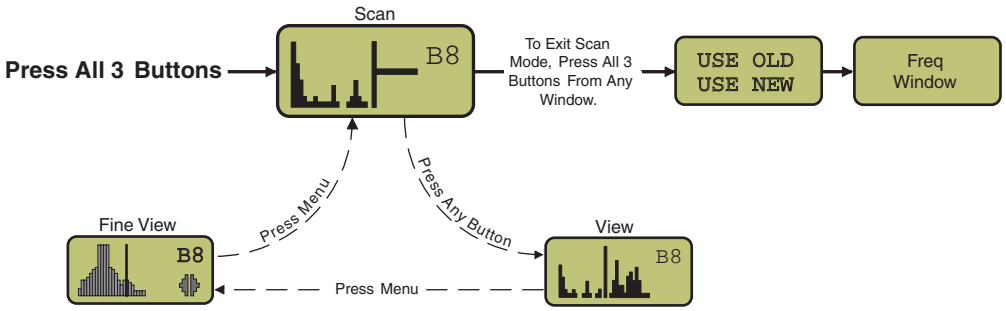
RF Spectrum Analyzer

The RF spectrum for UHF wireless microphones and IFB equipment has become increasingly crowded, due largely to the roll out of digital television broadcasts and the re-allocation of some spectrum for other services. More than ever, it is critically important to be able to find clear operating frequencies wherever a wireless system is going to operate. A built-in RF spectrum analyzer in the UCR401 addresses this situation.

An RF site scan and analysis can be conducted in less than a minute using the LCD interface. Simply pressing all three white buttons on the control panel sets the receiver into a scanning mode that sweeps the entire tuning range of the receiver in just over 20 seconds. The results of the scan are graphically displayed on the LCD showing the position and strength of RF signals detected, and the clear sections of the spectrum.

A marker in the display is scrolled to an area where there is no activity and the three buttons are pressed again. A message appears prompting the choice of the new frequency selected by scrolling, or the return to the previous frequency in place before the scan. When the frequency is selected, the display changes to a screen showing the selected frequency and the switch settings used on some transmitter models. The transmitter is set to the frequency and the system is ready for operation.

Using the receiver itself to conduct a site scan is especially beneficial because any RF signals that are the product of IM (intermodulation) that occurs inside the receiver will also be displayed. An external spectrum analyzer can accurately identify RF signals outside of the receiver but it will not include IM products.



A Rugged, Practical Package

The receiver is powered by two AA batteries or from an external DC source via a locking connector. NiMH rechargeable batteries are economical and especially effective because they provide extended operating time, which is consistent with continuous or intermittent use.

Audio is delivered via a balanced XLR connector, adjustable from mic to line level in 1 dB steps with the LCD interface on the front panel.

A machined aluminum housing and battery door are designed for heavy use in field production. The battery door remains attached to the housing when opened.

Specifications

Operating Frequencies (MHz):

Block 21:	537.600 - 563.100
Block 22:	563.200 - 588.700
Block 23:	588.800 - 607.900 614.100 - 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 944:	944.100 - 951.900

Frequency Adjustment Range: 25.5 MHz in 100 kHz steps

Channel Separation: 100 kHz

Receiver Type: Triple conversion, superheterodyne, 244 MHz , 10.7 MHz and 300 kHz

Frequency Stability: ±0.001 %

Front end bandwidth: 30 MHz @ -3 dB

Sensitivity

- **20 dB Sinad:** 1 uV (-107 dBm), A weighted
- **60 dB Quieting:** 1.5 uV (-104 dBm), A weighted

Squelch quieting: Greater than 100 dB

AM rejection: Greater than 60 dB, 2 uV to 1 Volt (Undetectable after processing)

Modulation acceptance: 85 kHz

Image and spurious rejection: 85 dB

Third order intercept: 0 dBm

Diversity method: Phased antenna combining - SmartDiversity™

FM Detector: Digital Pulse Counting Detector operating at 300 kHz

Antenna inputs: Two, fixed whip

Audio outputs Rear Panel XLR adjustable from -50 dBu to +5 dBu in 1 dB steps. Calibrated into a typical 10 k Ohm balanced load. Can drive 600 Ohm load.

Specifications subject to change without notice

Front Panel Controls and Indicators:

LCD control panel

- **Main window:** Pilot tone; antenna phase, receiver battery level; transmitter battery status; audio level, RF level
- **Frequency window:** Frequency, TV channel; Transmitter switch setting
- **Audio output level adjustment:** -50 dBu to +5 dBu
- **Battery level tracking:**
  - 0.1V steps, accuracy +/- 0.2V
  - Timer option available for NiMH batteries

Scanning mode: Coarse and fine modes for RF spectrum site scanning

Audio test tone: 1 kHz, -50 dBu to +5 dBu output in 1 dB steps; less than 1% THD

Transmitter battery type selection: 9 V alkaline, 9 V lithium, AA alkaline, AA lithium, TIMER

Phase invert: Audio output phase normal or inverted

Smart NR (noise reduction): OFF, NORMAL, FULL modes (avail in 400 Series mode only)

Audio Performance (overall system):

(These specs apply to 400 Series mode only.)

Frequency Response (Typ.): 32 Hz to 20 kHz (+/- 1 dB) System frequency response varies depending on transmitter used

THD: 0.2% (typical)

SNR at receiver output (dB):

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

Input Dynamic Range: 125 dB (with full Tx limiting)

Rear Panel Controls and features: XLR balanced audio output jack; External DC input; Battery compartment acces.

Power Options:

- **Ext DC:** Minimum 6 Volts to maximum 18 Volts DC; 1 W consumption, 80 mA at 12 VDC
- **Int Batt:** Two AA 1.5 Volt alkaline, lithium or NiMH;

Battery Life (typical):

- **AA alkaline** 4 hours continuous, up to 10 hours intermittent
- **AA lithium** Up to 11 hours (continuous and intermittent)
- **AA NiMH (2500 mAH)** 7.5 hours per charge typical (continuous and intermittent)

Weight: 13 oz with batteries.

Dimensions: 2.83" wide, 1.25" high, 4.64" deep (2.83 mm x 32 mm x118 mm)

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