U D R 2 0 0 B

RATIO DIVERSITY UHF RECEIVER

OPERATING INSTRUCTIONS
and trouble-shooting guide

L E C T R O S O N I C S, I N C.

Rio Rancho, NM

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GENERAL TECHNICAL DESCRIPTION

The UDR200B consists of two high performance, dual-conversion receivers operating simultaneously. The audio outputs of the receivers are blended in a ratio controlled by the comparative RF levels in the receivers. The multistage RF front end is a unique design that is tuned by a microprocessor to the selected frequency. The RF and audio performance is extremely stable over a very wide temperature range, making the UDR200B perfectly suited to mounting in studio equipment racks. The proprietary audio processing includes a dual-band compandor and dynamic noise filter for very low distortion and a superior signal to noise ratio. The squelch system is operated by a separate pilot tone and mutes the audio output directly at the output connector. The audio output is calibrated for exact level matching, with wide range, peak responding LED indicators.

RF SECTION

The problem posed to the design staff was to retain the RF reliability of the Lectrosonics' fixed frequency designs but add the frequency flexibility of a frequency agile design. The universal (and poor) way to build frequency agile systems is to design a wide open front end that will pass any frequency within the tuning range of the system. This leads to very poor RF performance with lots of interference, driving the user to switch frequencies in an attempt to sidestep the interference. This makes frequency agile receivers a self fulfilling system; you have to use the frequency agility to get away from the problems caused by the frequency agile design compromises.

The problem of frequency agility is further compounded when you realize that frequency changes "on the fly" cannot be made on any type of wireless system. For example, if there is suddenly an interference problem with a system in use, on stage for instance, a frequency change cannot be made without interrupting the program. Basically, the show must go on. In multi-channel applications, changing the frequency of one system will usually produce all kinds of new intermodulation problems with the other systems operating in the same location. Frequency agility is not the universal panacea for interference problems. It is only another tool and a limited tool at that. The first line of defense must be the system's basic immunity to interference. That required a new look at frequency agile receiver design.

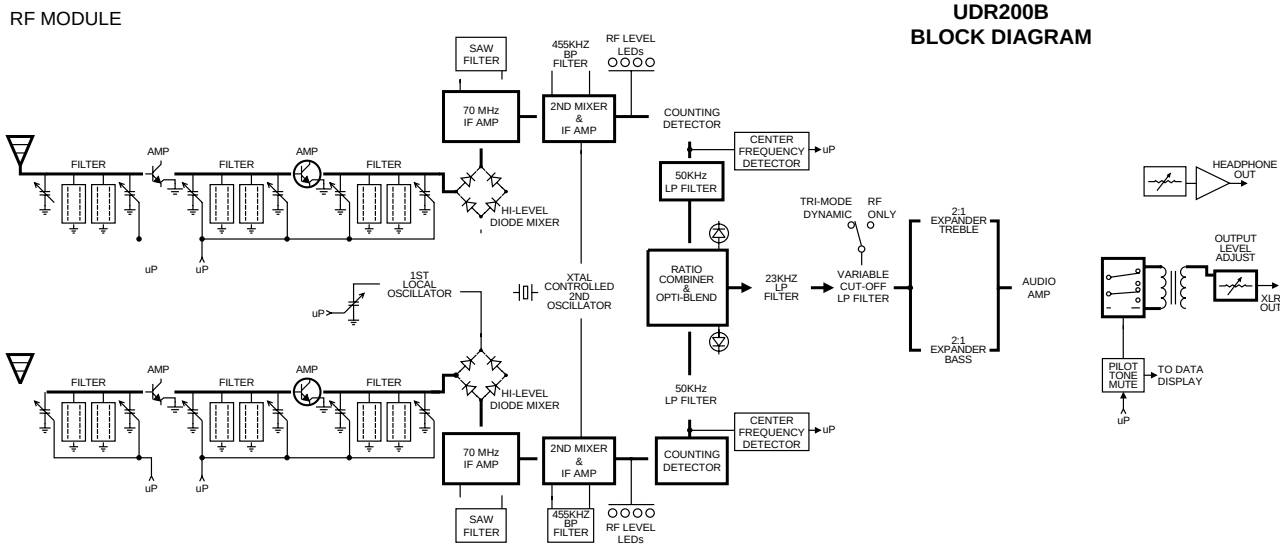
FREQUENCY TRACKING FRONT-END

Our solution to the wide open front end problem was to design a selective front end that can be tuned to the frequency in use. Since we wanted this front end to be equivalent to our fixed frequency front ends, this was a daunting task. Lectrosonics has always used front ends with more sections and much more selectivity than any other wireless manufacturer. The final design consisted of a total of 12 transmission line resonators with variable capacitance applied to each resonator by a microprocessor. This allows each resonator to be individually tuned by the microprocessor for any user selected frequency in a 25 MHz band. This sophistication produced a front end that was as selective as fixed frequency designs, yet could cover the entire 25 MHz range.

HIGH CURRENT LOW NOISE AMPLIFIERS

The gain stages in the front end use some rather special transistors in a feedback regulated high current circuit that combine three parameters that are generally at odds with one another. These are: low noise, low gain and relatively high power. It is easy to understand the advantages of low noise and high power capability but why is low gain desirable? The answer is that in a receiver, low gain allows the front end to handle stronger RF signals without output overload, which is "increased headroom," so to speak. The result of a design that takes all three of these parameters into consideration at once, is a low noise RF amplifier with a sensitivity rating equal or better than the best conventional design with a hundred times less susceptibility to intermodulation interference.

Combining the high power gain stages with the tracking front end produces a receiver that is unusually immune to single and multiple interfering signals close to the operating frequency and in addition strongly rejects signals that are much farther away.



DOUBLE BALANCED DIODE MIXERS

In all wireless receivers, a mixer is used to convert the carrier frequency to the IF frequency where most of the filtering and gain in the receiver takes place. After doing all the right things in the front end, it would be a shame to waste the performance with a second rate mixer. In other designs that is exactly what happens since mediocre mixers cause more intermodulation problems than mediocre front ends. The only solution was a high power, double balanced diode mixer driven by a local oscillator with more output power than most wireless transmitters (100 mW). The mixer in the UDR200B produces output at only the sum and difference signals, with minimal spurious signals. This mixer offers a very high overload threshold. The IF output of this mixer is at 71 MHz which is unusually high for a wireless receiver. This high frequency was chosen to increase the image rejection in the front end to as high as our fixed frequency designs. The mixer is followed by low noise amplifiers and SAW filters to preserve the superior RF performance.

SURFACE ACOUSTIC WAVE FILTER

The UDR200B is unique in that it uses state of the art SAW filters in each IF section. The SAW filters are the only filter that can combine sharp skirts, constant group delay, and wide bandwidth in one filter. Though expensive, this special type of filter allows us to follow the basic receiver rule of doing the primary filtering as early as possible, at as high a frequency as possible and before high gain is applied to the signal. Since these filters are made of quartz, they are very temperature stable. Conventional LC filters at these frequencies would drift unacceptably in the elevated temperatures of an equipment rack. After following the rule in a rigorous way, and due to the sharp filtering action of the SAW filters, the 71MHz signal is converted to the low frequency of 455 kHz. Lots of gain is then applied in a conventional IC and the signal is then converted to audio. 455 kHz is very unconventional for a second IF in a wide deviation (±75 kHz) system. We chose to use 455 kHz to obtain an outstanding AM rejection figure over a very wide range of signal strengths and to produce an excellent noise improvement at low signal strengths (capture ratio). To use an IF at 455 kHz requires an unusual circuit to convert the IF to audio.

DIGITAL PULSE COUNTING DETECTOR

The UDR200B receiver uses an advanced digital pulse detector to demodulate the FM signal, rather than a conventional quadrature detector. The common problem with quadrature detectors is thermal drift, particularly those that operate at higher frequencies like 10.7 MHz. Though the quadrature detectors may work well at room temperature, if they are not carefully compensated, they will produce amplitude changes and audio distortion in the elevated temperatures of an equipment rack. Some manufacturers try to get around the problem by tuning their systems at higher temperatures after they've been on for some time. This just means that for the first hours in a cool room the receiver is well out of specification or after a few hours in a hot rack.

The UDR200B design presents an elegantly simple, yet highly effective solution to this age old problem. The UDR200B detector basically works like this: A stream of precision pulses is generated at 455KHz locked to the FM signal coming from the 455 kHz IF section. The pulse width is constant, but the timing between pulses varies with the frequency shift of the FM signal. The integrated voltage of the pulses within any given time interval varies in direct proportion to the frequency modulation of the radio signal. Another way of describing it is that as the FM modulation increases the frequency, the circuit produces more pulses and as the modulation decreases the frequency, the circuit produces fewer pulses. More pulses produces a higher voltage and fewer pulses a lower voltage. The resultant varying voltage is the audio signal.

This type of detector eliminates the traditional problems with quadrature detectors and provides very low audio distortion, high temperature stability and stable audio level. The counting detector also adds additional AM rejection, in addition to the limiting in the IF section. The amplitude of the pulses is constant, so level differences in the IF signal do not affect the pulse. The two resulting audio signals from the A and B receiver channels are then combined to achieve the maximum benefits of diversity reception.

RATIO COMBINING DIVERSITY WITH OPTI-BLEND™

Instead of the usual audio switching between the two receivers, we blend the audio outputs of the receivers in a ratio controlled by the RF level of the received signals in the two receivers. This totally eliminates any of the switching noise sometimes heard in other designs and improves the signal to noise ratio an additional 6 dB under weak signal conditions and 3 dB in strong signal conditions.

TRI MODE DYNAMIC FILTER

After being combined in the Opti-Blend circuit, the audio signal is passed through a "dynamic noise reduction circuit". The cutoff frequency of this filter is varied automatically by measuring the amplitude and frequency of the audio signal and the quality of the RF signal. The audio bandwidth is held only to that point necessary to pass the highest frequency audio signal present at the time. If the RF level is weak, then the filter becomes more aggressive. This results in a dramatic reduction of "hiss" at all times. During passages with a high frequency content, this filter gets completely "out of the way" and passes the signal with no decrease in high-frequency response. Keep in mind that if hiss is added to a signal, there is a psycho acoustic effect that makes the sound seem brighter. The other side of this is that if hiss is removed from a signal it will sound duller. Basically the ear's detection apparatus is pre-sensitized to high frequency sounds by small amounts of high frequency hiss. Consider this effect when making a judgment about the sound quality of various wireless systems and this particular filter. We have satisfied ourselves through elaborate tests that this filter is totally transparent. There is one circumstance where a good argument can be made for bypassing this filter, so a switch is provided to do just that.

RF ONLY NOISE FILTER

A small switch on the rear of the receiver will allow the noise filter to be set for RF ONLY. In this mode the filter is held out of

the audio frequency range unless the RF level drops to very low levels. At weak RF levels, the filter operates in the TRI MODE state until the RF level rises back to acceptable levels. This has the desirable effect of softening dropouts. We recommend using the RF ONLY setting when it is desirable to pick up high frequency background noise, such as for a location shot for a movie. This might be machinery noise, compressed air, etc. If the desirable background noise is at a low level, the Tri Mode Dynamic Filter will identify this as undesirable hiss and effectively remove it.

2:1 EXPANDER (Dual–Band Compandor)

"Dual-band Companding" is a complimentary system, that is, whatever is done in the transmitter must be exactly mirrored in the receiver. The transmitter compresses the audio signal in two separate audio bands using four separate time constants to avoid the inevitable trade-offs in attack and decay times that occur in a single-band compandor. The companion circuit in the receiver then re-expands this compressed signal restoring the original dynamic range and frequency characteristics of the signal.

The mixed audio signal leaves the Opti-Blend circuit and is fed through a 23 kHz low pass filter where all the high frequency noise (including the 32 kHz pilot tone) is filtered out. After the 23 kHz low pass filter, the signal is split into two parts via a 1 kHz low pass filter and a 1 kHz high pass filter. The separated signals are then processed in separate channels of the 2:1 expander. Each channel of the 2:1 expander is optimized for its respective frequency band. By optimizing the compandors for high and low frequencies we can handle sounds such as clicks, sibilants and fast transients produced by plucked or struck instruments in the high frequency section without compromising the performance in the main voice range. The two outputs of the 2:1 expander are then summed in an op-amp and sent to an audio amplifier as one signal.

PILOT TONE MUTE (SQUELCH)

The 200 system utilizes a separate ultrasonic tone modulation of the basic carrier to operate the receiver squelch. In the transmitter, a 32.765 kHz tone is injected into the audio signal after the microphone preamp, just after the compandor. The supersonic pilot tone is filtered out of the audio signal immediately after the detector in the receiver so that it does not influence the compandor or various gain stages.

The basic benefit of the pilot tone squelch system is that the receiver will remain squelched (muted) until it receives the pilot tone from the matching transmitter, even if a strong RF signal is present on the carrier frequency of the system. Once a pilot tone is detected, the receiver will remain open during all signal conditions. If the transmitter signal degrades to the point where hiss and noise may become objectionable, the Opti-Blend circuitry and Tri Mode Dynamic Filter will work to reduce or eliminate the unwanted noise. Since the pilot tone keeps the receiver audio output open, as soon as the transmitter signal returns to normal, the audio signal is instantly available with no delays. A conventional squelch system, on the other hand, can briefly interrupt the audio during a near drop-out condition.

The pilot tone mute circuit drives a relay which physically disconnects the output amplifier from the output audio transformer. The relay then connects the transformer primary to ground to prevent hum pickup in the transformer due to an open primary winding. This provides complete muting of the audio and the noise. The pilot tone function may be bypassed with a rear panel push button. Once pushed, the pilot tone mute is "latched" in a disabled condition until the receiver is powered off then back on. When the pilot tone is disabled, there is still a "squelching" function provided by the Opti-Blend circuitry and Tri Mode Dynamic Filter. These circuits can provide approximately 50 dB of muting during weak or no signal conditions when the pilot tone is disabled. If you hear moderate hiss when the transmitter is off, the pilot tone has probably been bypassed.

AUDIO OUTPUT

The audio is a fully floating, transformer coupled, balanced signal. Pin 2 is "high" or in phase with the transmitter input. A precision attenuator allows you to adjust the output level from +20 to -35 dBu. The output always runs "wide open" and is only attenuated by this output level control. Neither the noise level in the receiver nor headroom is affected. You can, however, over drive or under drive attached audio equipment.

A ground lift switch is available to disconnect pin 1 of the 3 pin XLR if a hum loop is encountered. Never, never cut off the ground plug on the AC cable. The ground lift switch will accomplish the same audio results without the safety hazard.

If a single ended output is necessary, pin 3 (or pin2) must be tied to ground, preferably at the end of the cable with the single ended connector. Other Lectrosonics equipment is not transformer coupled and will work without the pin 3 ground connection. This fully floating output will not.

The headphone output is a high quality signal derived from 4 high current op amps operating in parallel to provide a low noise, low distortion signal. This output can be used as an unbalanced output if needed. Unlike the rear panel balanced output, this output can be overdriven if the headphone volume control is set too high. As with any headphone output, keep the sound levels in the headphones at a moderate level. When the output is not being used, turn it all the way down. Be careful to not turn up the headphone gain if the receiver is muted or squelched. As with any output that is muted, there is no way of knowing what the level will be when the receiver audio is opened.

FRONT PANEL CONTROLS AND FUNCTIONS

TRANSMITTER AUDIO LEVEL

The modulation (audio level) of the incoming signal is indicated by a fast responding LED strip. The strip is calibrated in 6dB steps over an expanded scale (54dB) which provides an extremely accurate visual “picture” of the signal dynamics, even at a distance away from the receiver. The LED strip is fast enough to track even brief transients, easily exceeding the response time of conventional VU meters.

RF LEVEL INDICATORS

Two separate LED strips are provided to indicate the level of the incoming RF signals. The LED strips are calibrated to provide accurate indications from 1uV to 1mV. The LEDs are highly visible from a distance, making antenna set up more accurate. The dual LED strips are especially useful in “trouble-shooting” difficult antenna installations.

OPTI-BLEND LEDs

The UDR200B receiver operates with a method of audio ratio blending of two audio outputs. RF level in each receiver is compared and the audio signals from the two receivers are mixed together in a ratio that favors the quieter receiver. As this blending action occurs, the brightness of the two OPTI-BLEND LEDs will vary. The brighter the LED, the more audio is being mixed in from that receiver.

FULL INFORMATION DISPLAY

The UDR200B receiver includes a 16-segment LED character strip that provides information about the selected frequency, group, required transmitter setting, TV channel, assigned user name, locked/unlocked status and pilot tone status.

PILOT INDICATOR

The audio output muting (squelch) function of the UDR200B is controlled by a 33kHz tone modulation of the RF carrier. The audio output is muted until this tone is present. The muted condition is indicated by a blinking TX switch setting in the LED display.

The pilot tone function can be defeated by pressing a switch on the rear panel. The PILOT indicator, however, operates the same regardless of whether or not the defeat switch is pressed. The PILOT indicator strictly indicates the presence of the pilot tone carrier from the transmitter.

DIVERSITY MODE

This switch is set to the DIVERSITY position for normal operation. For trouble-shooting or when the receiver is used with a single antenna, the switch can be set to select a single antenna only.

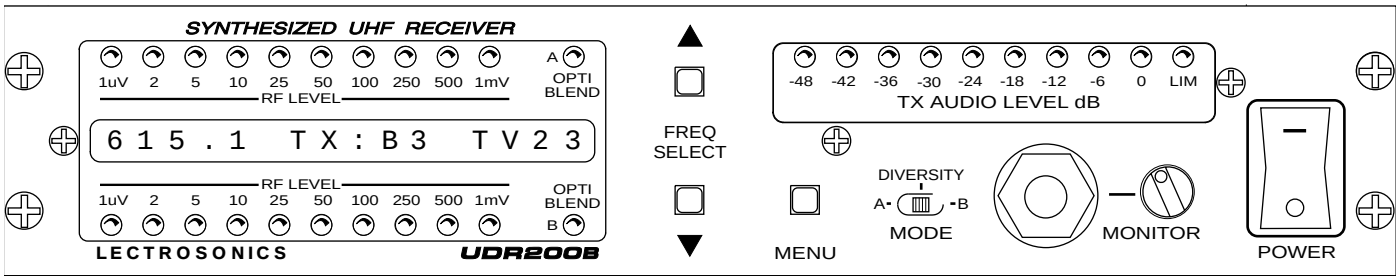
MONITOR

This is an audio output to drive a wide variety of different types of headphones. It is also usable as a second high quality audio output to drive recorders or external audio devices.

POWER

Pressing the upper half of the rocker switch applies power to the receiver. At turn on, there are various relays and delays built into the receiver to allow various stages to stabilize before the audio output is activated. This will prevent an audio “thump” when powering up the receiver and/or the transmitter.

The UDR200B has a universal switching power supply which will operate on AC voltages from 95 to 240Volts, 50 or 60Hz.



UDR200B Front Panel

REAR PANEL CONTROLS AND FUNCTIONS

AUDIO OUTPUT

A calibrated control on the rear panel adjusts the output level in 5 dB steps, referenced in dBu. This control knob adjusts the absolute output level at the XLR connector. The AUDIO OUTPUT level control is located after the output transformer. This allows the signal to noise ratio to remain constant regardless of the setting of the control. As the audio level is reduced, the noise is also reduced maintaining the same ratio.

PHASE REV

This switch reverses the polarity of the audio output signal. The "0" setting corresponds to a positive signal at the transmitter input producing a positive output on pin 2 of the XLR audio output connector.

AC POWER SUPPLIES

The UDR200B has a universal switching power supply which will operate on AC voltages from 95 to 240 Volts, 50 or 60 Hz. There is no external fuse since the power supply is self protected against line transients, short circuits, and over current conditions.

EXT DC IN

The primary purpose of this jack is to provide battery backup in case of a loss of normal AC power. The receiver will accept power from this jack under two conditions. The first is whenever the front panel power switch is in the OFF position and the second is when the front panel power switch is in the ON position *and* the normal AC power fails or is removed. This jack can also be used to provide normal DC power to the receiver, if desired, although the power switch OFF position will not function as expected. When using this jack to provide normal DC power the receiver will always be ON regardless of the position of the front panel power switch.

The external DC source can be 12 to 26 VDC. Pin 4 is positive and pin 1 is ground. This jack will accept a standard 4-pin female XLR connector. The relays and power supply stage are fully protected by automatic reset poly fuses. The ground side of the power supply is protected with a self resetting poly fuse in case the UDR200B is connected to a positive ground device through the audio cabling. The poly fuse will trip to protect the receiver and the offending ground path can then be removed.

LecNet (RS232) JACK

This 3.5mm stereo mini jack provides the serial connection between the receiver and the computer. A stereo mini to DB9 cable is supplied with the receiver.

ANTENNA JACKS

These are standard 50 Ohm BNC terminals for the RF input to the receiver.

EXPANSION OUT, EXPANSION IN

These miniature jacks provide the serial port interface for multi-channel systems in a “daisy chain” manner. The receiver that connects to the computer uses the IN jack to receive signals and information from the OUT jack on the next receiver in the chain.

See the interconnect diagram on the next page.

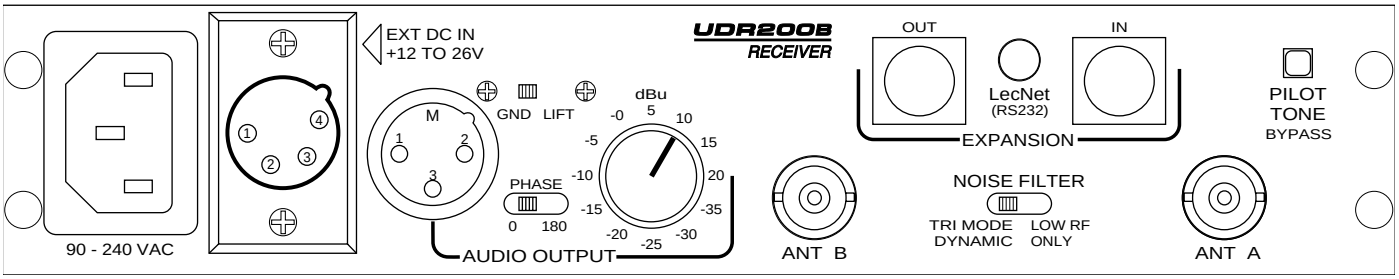
PILOT TONE BYPASS

This switch defeats the audio output muting and triggering action of the pilot tone. When the pilot tone is bypassed, the Opti-Blend and the Variable Cutoff Low Pass Filter will still provide a squelching action during weak signal conditions. These circuits will still provide approximately 50 dB of muting when the pilot tone is bypassed. When bypassed, a warning message is displayed on the front panel LED character strip.

NOISE FILTER

A sophisticated dynamic noise reduction filter can be switched to operate in two different modes. The most effective mode is the “TRI MODE DYNAMIC”. This mode derives a signal that is proportional to the high frequency content of the desired audio signal multiplied by the amplitude of the desired audio signal and divided by the RF noise level. This derived signal controls a proportional low pass noise filter that responds to transient high frequency signals in less than a millisecond; this speed is commonly accepted as much faster than the human ear can resolve. Basically, the filter gets out of the way of high frequency audio information so quickly that the ear cannot detect its operation. In addition this filter reduces high frequency room noise and also the electronic microphone noise that is present to some extent in all small electret microphones.

It may sound as if the filter is dulling the sound but this is a well known psycho acoustic effect of reducing high frequency noise. The ear is sensitized or fooled by hiss to “hear” more high frequencies. The second mode, “LOW RF ONLY”, operates the filter only when the RF link between transmitter and receiver is unusually weak, less than 5uV at the receiver antennas. This is a relatively rare circumstance and so the noise filter is effectively out of the circuit except when absolutely needed.



UDR200B Rear Panel

INSTALLATION AND OPERATING INSTRUCTIONS

1) Locate a suitable operating location where the receiver will not be subjected to extreme temperature variations and possible bumps and drops. Try to route all wiring so it will not cross walkways or isles.

2) Connect the power. For AC operation, connect the power cord to the AC input jack on the rear panel and plug the other end into a suitable electrical outlet. If 12 to 26V DC operation/battery backup is desired, a power cord will need to be fabricated. Use a standard 4-pin female XLR connector for the receiver end. Pin 4 is positive and pin 1 is ground. Make the length of the DC cable long enough to suit your installation and prepare and connect the source end of the cable.

3) Attach the antenna cables to the BNC jacks on the rear of the UDR200B and place the antennas. Best performance will be obtained if the antennas are placed at least 3 feet from each other. Try to mount them as high as possible with a direct line of sight path to the transmitter if possible.

4) Set the Audio Output level control to minimum (CCW) and connect the Audio Output XLR jack to the mixer input. Pins 2 and 3 of the XLR jack are HI and LO and can be reversed with the Phase switch, pin 1 is common.

5) Preset the following controls:

MODE (front panel) to DIVERSITY
MONITOR (front panel) to minimum (CCW)
PHASE (rear panel) to 0
AUDIO OUTPUT (rear panel) to -40 (full CCW)

6) Turn the unit on with the front panel POWER switch and check to see that the PILOT indicator is blinking indicating that the pilot tone is not being received (be sure the transmitter is turned off.)

7) Set the operating frequency on the transmitter and receiver. (See “Using the LED Information Display” below.)

8) Turn on the transmitter and adjust the transmitter gain.

This is the most important step in the setup procedure!

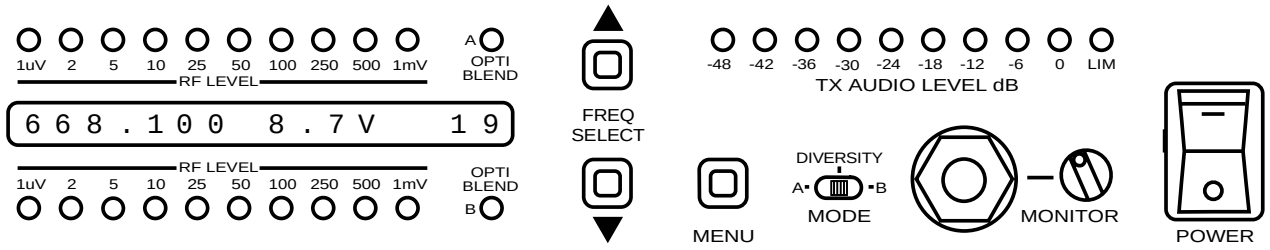
Adjust the transmitter so that voice peaks will light the 0 LED on the receiver front panel Transmitter Audio Level dB strip. The red "0" or LIMIT LED on the transmitter may flash occasionally. This is normal but it should not happen continuously. See your transmitter manual (Operating Instructions section) for specific directions on how to adjust the gain of your particular transmitter.

9) After adjusting the transmitter gain, set the rear panel Audio Output level control to the desired level. The -40 setting is approximately equal to 10mV, the 0 position will give 0.775VRMS, and the +15 setting will allow up to 4.4 VRMS. This setting will depend on the requirements of your system.

10) Operate the system and readjust the receiver output level as required for your equipment. The input levels on different VCR’s and PA equipment vary, which may require that you set the Audio Output control in an intermediate position. Try different settings and listen to the results. If the output of the receiver is too high, you may hear distortion or a loss of the natural dynamics of the audio signal. If the output is too low, you may hear steady noise (hiss) along with the audio.

Note: If two or more UDR200B receivers are used together and the LecNet computer interface is used, a unique LecNet address must be entered into each receiver. See page 10 under *Set LecNet Address*.

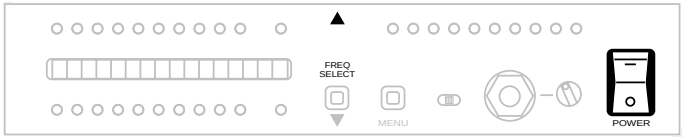
USING THE LED INFORMATION DISPLAY



The UDR200B has three power up options and four menu options which control all aspects of the receiver's operation.

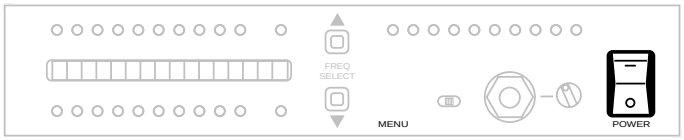
POWER UP OPTIONS

Toggle Battery Monitor Display- Holding in the UP button while powering on the receiver will toggle on and off the LED display that indicates the transmitter battery voltage. (Note: the battery status display will not function unless a valid pilot tone is being received.)



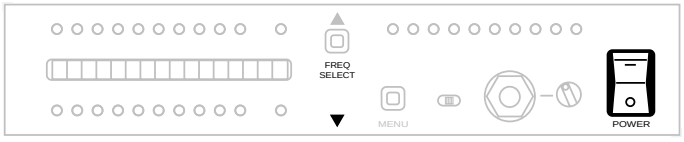
Turning off the battery status display prevents confusion when the UDR200B receiver is used with 195 Series or early 200 Series transmitters that lack the battery monitor function. When toggled off, the first LED display to appear (following the brief status displays) will indicate the receiver frequency and TV channel.

Set/Reset Hard Lock Mode - Holding down the MENU button while powering on the receiver will switch the receiver between the UNLOCKED mode and the HARD LOCKED mode.



In the UNLOCKED mode, all receiver menu options may be adjusted. In the HARD LOCKED mode, the MENU button may be used to scroll through the menus, but no adjustments may be made. If this option is selected, the receiver will display its current status for about 2 seconds after turn on before reverting to the Set Receiver Frequency menu.

Set LecNet Address - Holding down the DOWN button while powering on the receiver allows the LecNet address of the receiver to be set.



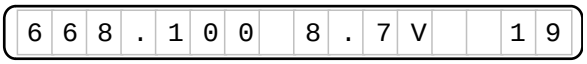
Setting each UDR200B to a unique address is critical when more than one receiver is connected to a PC. The address setting should be accomplished before starting the LecNet Master Pro application. UDR200Bs are shipped from the factory with a LecNet address of 150. Multiple UDR200Bs in a system should be assigned unique addresses above 150. You will see the following displayed on the LED display of the UDR200B in the address setting mode:

Use the UP and DOWN buttons to set the receiver to an unused address. Then press the MENU button. This will store the new address, and put the UDR200B in its normal operating mode.

MENU OPTIONS

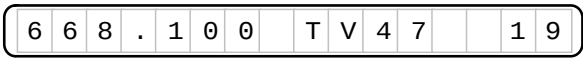
Press the menu button to select the desired menu option. Each menu option is described below.

Set Receiver Frequency/Display Tx Battery Voltage - When the receiver is powered up in the "Display Battery Status" power up mode and the transmitter is turned on, the following will be shown:



This display is only shown in the "Display Battery Status" power up mode. It will not appear when the battery status display is toggled off.

Set Receiver Frequency/Display TV Channel - This display will appear first when the battery monitor option is toggled off. It will also appear when the MENU buttion is pressed if the battery monitor option is toggled on. This menu allows the receiver frequency to be set either to the stored frequencies in the currently active group or to any frequency in the receiver's block in 100kHz steps. You will see the following menu option displayed on the LED display of the UDR200B in the frequency setting mode:



The first number shows the current receiver frequency in MHz, the second shows the UHF TV channel in which the current frequency falls, and the third shows the transmitter (TX) setting which matches the current receiver frequency. The TX setting will flash if no valid Pilot Tone is detected at the current fre-

quency, and will stop flashing when a valid Pilot Tone is detected.

Use the UP and DOWN buttons on the receiver front panel to select from frequencies stored in the currently active group. The UP and DOWN buttons will repeat if pushed and held. The display will blink to indicate that the highest or lowest frequency in the current group has been reached. To select frequencies in 100kHz steps, press the MENU button plus the UP or DOWN buttons. Press the MENU button to move to the next menu option.

Set Receiver Frequency by Name/Modify Frequency Name - The second menu option shows the name associated with each frequency stored in the current active group. This option allows you to choose receiver frequencies by name from among those pre-programmed into the current active group. The name associated with the stored frequency can also be modified. If the current receiver frequency is one stored in the current active group, you will see the following menu option displayed on the LED display of the UDR200B:

```
LECTRO 1          19
```

The first group of characters, up to 13, is the name assigned to the stored frequency. The last two digits are the transmitter (TX) setting which matches the current receiver frequency. If the current receiver frequency is not one stored in the current active group, you will see the following menu option displayed on the LED display of the UDR200B:

```
GRP1 SELECT       20
```

This indicates the current frequency is not a stored frequency in the currently active group, and that no name can be associated with it.

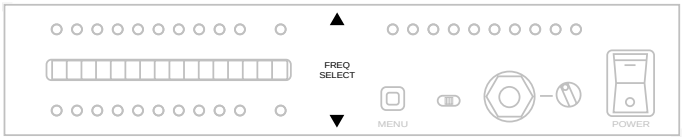
The UP and DOWN FREQ SELECT buttons will select from stored frequencies in the current group. To modify the name associated with the stored frequency, press the MENU button plus the UP or DOWN buttons. The first press of either the UP or DOWN plus MENU buttons will start the name modification process. The letter to be changed will begin to flash to signal the name modification mode. To change this letter, press the UP or DOWN buttons to cycle through all the allowable characters until the desired character is reached. To leave this letter unmodified and move to a new letter, press the MENU plus UP buttons to select the next letter to the right, or the MENU plus DOWN buttons to select the next letter to the left. If there is no letter in a selected character position, a flashing underscore will be displayed as a position indicator. After all desired modifications have been made, press the MENU button. The name, as modified, will be shown in the display. Press the MENU button again to move to the next menu option.

Frequency Search - The third menu option sets the receiver to search for RF signal energy above a minimum threshold, which is 2uV at either antenna port. The receiver will search all frequencies in 100kHz steps, or will search only the stored frequencies for the current active group. You will see the following menu option displayed on the LED display of the UDR200B in the frequency setting mode:

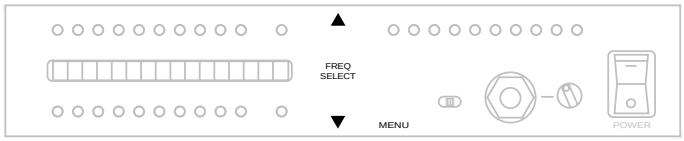
```
SRCH:668.100      20
```

The display shows the current frequency, and the TX setting associated with that frequency.

To search only the active group frequencies, press only the UP or the DOWN buttons as shown below.



To search by 100kHz steps, hold the MENU button in while pressing the UP or DOWN buttons as shown below.



As a search progresses, the current search frequency will be displayed. Press the MENU button to end the search mode and move back to the last menu option.

Change Active Group/Operational Mode - The last menu option allows selection of the current active group to be used with the other three menu options. In addition, the operational mode may be switched between UNLOCKED and LOCKED. You will see one of the following displayed on the **LED** display of the UDR200B, depending on the current operational mode:

```
GROUP1: UNLOCKED
```

or

```
GROUP1: LOCKED
```

or

```
GROUP1: HRD LOCK
```

The group number just to the left of the colon is the current active group. The current operational status is shown to the right of the colon. The UP and DOWN buttons may be used to select from among up to four stored groups (i.e. groups 1, 2, 3, and 4). Only groups in which frequencies are actually stored appear as selections when the UP or DOWN buttons are pushed.

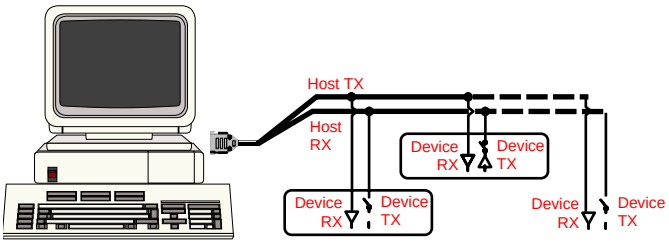
To change the operational mode, use the MENU plus UP or DOWN buttons. In the UNLOCKED mode, all receiver menu options may be adjusted. In the LOCKED mode, the MENU button may be used to scroll through the menus, but no menu options may be adjusted until the mode is changed back to UNLOCKED. The system may be changed from UNLOCKED to LOCKED mode and back in this menu. In the HARD LOCKED mode, the MENU button may be used to scroll through the menus, but no adjustments may be made. This must be done using the Set/Reset Hard Lock Mode power up option (see **Set/Reset Hard Lock Mode** section above).

Changes to the contents of stored groups cannot be made from the receiver front panel. These changes must be made from an external PC using the LecNet software.

LecNet™ COMPUTER INTERFACE

Lectrosonics' LecNet system is a unique implementation of standard RS-232 serial communications. Since it is compatible with RS-232 serial ports found on all PCs, no extra interface cards are necessary to add computer control to your LecNet equipment. The figure below shows a representation of a LecNet setup. Unlike standard RS-232 equipment, where one serial port connects to only one device, as many as 127 LecNet devices may be simultaneously connected to a single serial port.

As the figure shows, LecNet devices can always receive



information from the host. In this way, each LecNet device "listens" for its unique network address "broadcast" from the host PC. When a device "hears" its address, it closes its Device Tx switch to reply to the host. The Device Tx switch is held closed until the data exchange with the host is complete. The device then opens its Device Tx switch. In this way, device contention is avoided. Each LecNet device must have a unique address between 128 and 254. Any device address is reassignable using the LecNet Master Pro application (supplied free with every LecNet device).

The LecNet runs at a fixed rate of 9600 bps, which is not user adjustable. This is fast enough to provide quasi-real time response to the control panels while insuring reliable communications over reasonable distances (100 feet from host to LecNet device). The serial communications parameters used are 8 data bits, no parity, 1 stop bit.

LecNet HARDWARE HINTS

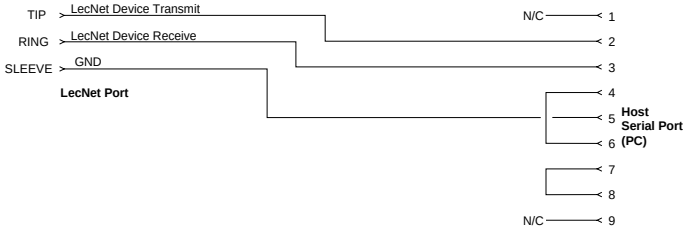
Connecting LecNet devices to a host using the LecNet is straightforward. Using the special LecNet RS-232 cable (Lectrosonics Part #21529), simply connect Com1, 2, 3 or 4 on the host to the LecNet 3.5mm input on one of the LecNet devices. If a custom length cable is necessary, the figure to the right shows the cable connection schematic. The host-to-device connection assumes that multiple LecNet devices (if more than one are used) are interconnected using the 8 pin expansion cable (Lectrosonics Part #21551).

While Lectrosonics has made every effort to make the serial communications software as compatible as possible with a wide range of serial ports, some serial ports are not well behaved. Some problems occur with older serial ports, because they may not be reliable at 9600 bps or higher. Software is available (from Norton, for example) which will test serial ports and determine the highest reliable data rate.

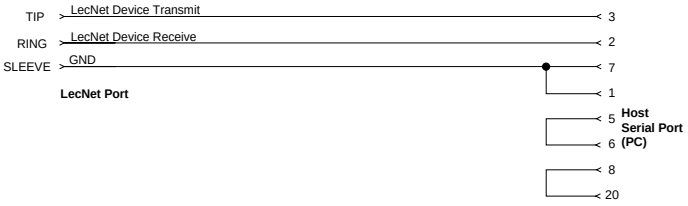
In addition, Windows video drivers sometimes interfere with com port operation. For example, the custom video driver supplied with the Toshiba 1900/1910 series laptop computers will crash the com port when it is used for LecNet operation. The fix for this situation is simply to use the generic VGA video driver (chosen from the Windows Setup application). Watch for video driver interactions any time a nonstandard video driver is used.

SERIAL HARDWARE CONNECTIONS

WIRING DIAGRAM, 9 PIN D-SUB



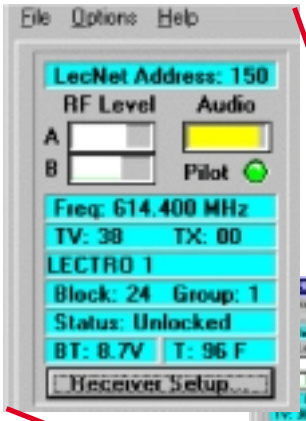
WIRING DIAGRAM, 25 PIN D-SUB



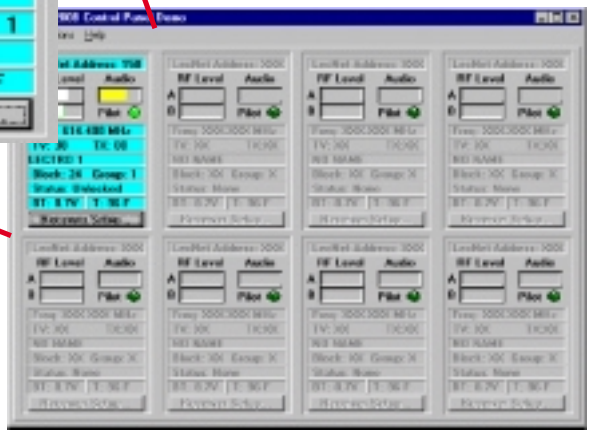
LecNet™ COMPUTER INTERFACE

MICROPROCESSOR CONTROL

An internal microprocessor controls the frequency settings and display, and provides a user friendly interface for setup and operation. 256 frequencies are available in 100KHz steps. The 25.6 MHz bandwidth covers more than four UHF television channels to allow maximum flexibility in frequency coordination for congested RF environments and in travelling venues.



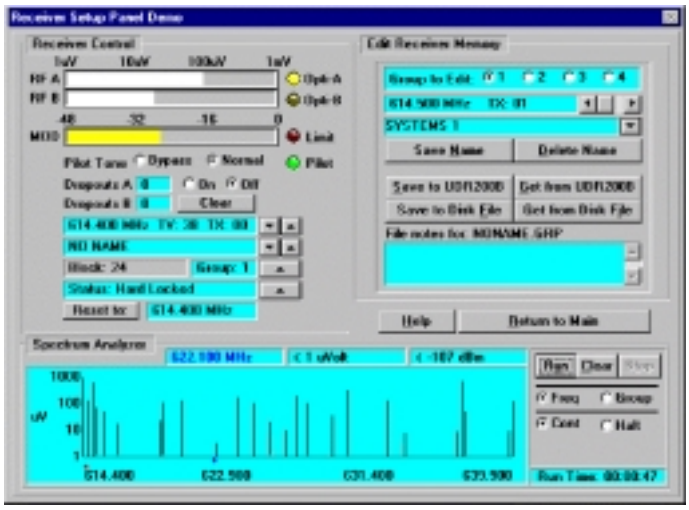
For multi-channel systems, each UDR200B receiver is assigned a unique serial address from the front panel of the receiver. When the LecNet™ Master Pro software is then launched, a role call is initially taken to identify all devices that are connected.



THE LecNet™ INTERFACE

All setup functions and almost all operational functions are available from the UDR200B front panel without the use of a PC. Via a PC, several other features are added to simplify setup and enhance monitoring during operation. LecNet™ software is supplied with the UDR200B.

The first display that appears when the UDR200B software is loaded is a composite summary of up to 8 receivers, showing basic RF and audio levels and frequency settings. Each of the 8 display screens includes a button to switch to the complete control panel for that specific receiver.



When the “Receiver Setup” button is clicked, a detailed display appears with a wide variety of information dynamically displayed. RF and audio levels, Opti-Blend™ panning activity, frequency, pilot tone status, user and group names for each receiver, and all information provided by the front panel LED character strip is clearly displayed. Frequencies can be changed to any frequency within the range of the receiver, or to only those included in a previously selected, compatible grouping.

The individual receiver control panel includes three sections to display current settings, provide a workspace for new frequency groups and a spectrum analyzer section for site surveys.

AUTO SEARCH FUNCTION

The UDR200B provides the installer with a convenient method of conducting a “site survey” when setting up for a new venue or installation. The Auto Search function scans either the entire tuning range of the receiver, or a selected frequency group, and locates RF signals in the vicinity. The results are graphically displayed in the lower section of the screen. The screen markers are a peak holding type to record activity over any chosen time period. The Auto Search procedure is especially valuable in travelling or rental venues that set up and tear down frequently.

FREQUENCY BLOCKS AND RANGES

The table below lists the factory designated frequency ranges available for the UDR200B receiver. For convenience, the table includes information about the UM200B belt-pack transmitter antennas as well.

Each UDR200B receiver is built to cover a pre-selected range of frequencies (a “block”) as shown below. The receiver will tune to any of 256 different frequencies within this factory assigned block.

The block number is determined by this formula:

25.6 × Freq. (MHz) = Lowest freq. (MHz) in the block

To determine a block number from a frequency:

Freq. (MHz) divided by 25.6 = Block number

It is handy to remember these formulas, in case you do not have a copy of the table. For example, suppose you need to know which block covers 685.500 MHz, without using the table:

685.500 divided by 25.6 = 26.77734375

The first two digits left of the decimal are the block number. In this case, 685.500 MHz falls within block 26.

These factory defined "blocks" of frequencies should not be confused with the user defined "groups" that can be stored in the receiver memory.

Four user defined groups of frequencies can be stored in the receiver memory. The groups are numbered 1 through 4 as depicted on the Receiver Setup Panel (see the section on COMPUTER INTERFACE). Each frequency in a group can be individually named for convenience.

The UM200B belt-pack transmitter antennas (model A6U) are color coded to indicate the frequency block that they operate within. The length of the antenna varies with the frequency block. The actual length of the antenna is not as critical as it might appear in the table below. The usable bandwidth of the A6U antennas are +/- 50 MHz from the center frequency, so it is acceptable to use an antenna from an adjacent block above or below the operating frequency.

The color of the antenna sleeve is in keeping with standard resistor value color codes for the second digit of the block number. Block 23 is not used since it covers a 608 to 614 MHz band that is illegal for use with wireless microphones.

BLOCK	FREQUENCY RANGE	ANT SLEEVE COLOR	ANTENNA WHIP LENGTH
21	537.600 - 563.100	Brown	4.74"
22	563.200 - 588.700	Red	4.48"
23	588.800 - 614.300	Orange	4.24”
24	614.400 - 639.900	Yellow	4.01"
25	640.000 - 665.500	Green	3.81"
26	665.600 - 691.100	Blue	3.62"
27	691.200 - 716.700	Violet (Pink)	3.46"
28	716.800 - 742.300	Grey	3.31"
29	742.400 - 767.900	White	3.18"
30	768.000 - 793.500	Orange/Black	3.08"
31	793.600 - 819.100	Orange/Brown	2.99”
32	819.200 - 844.700	Orange/Red	2.92”
33	844.800 - 865.000	Orange/Orange	2.87”

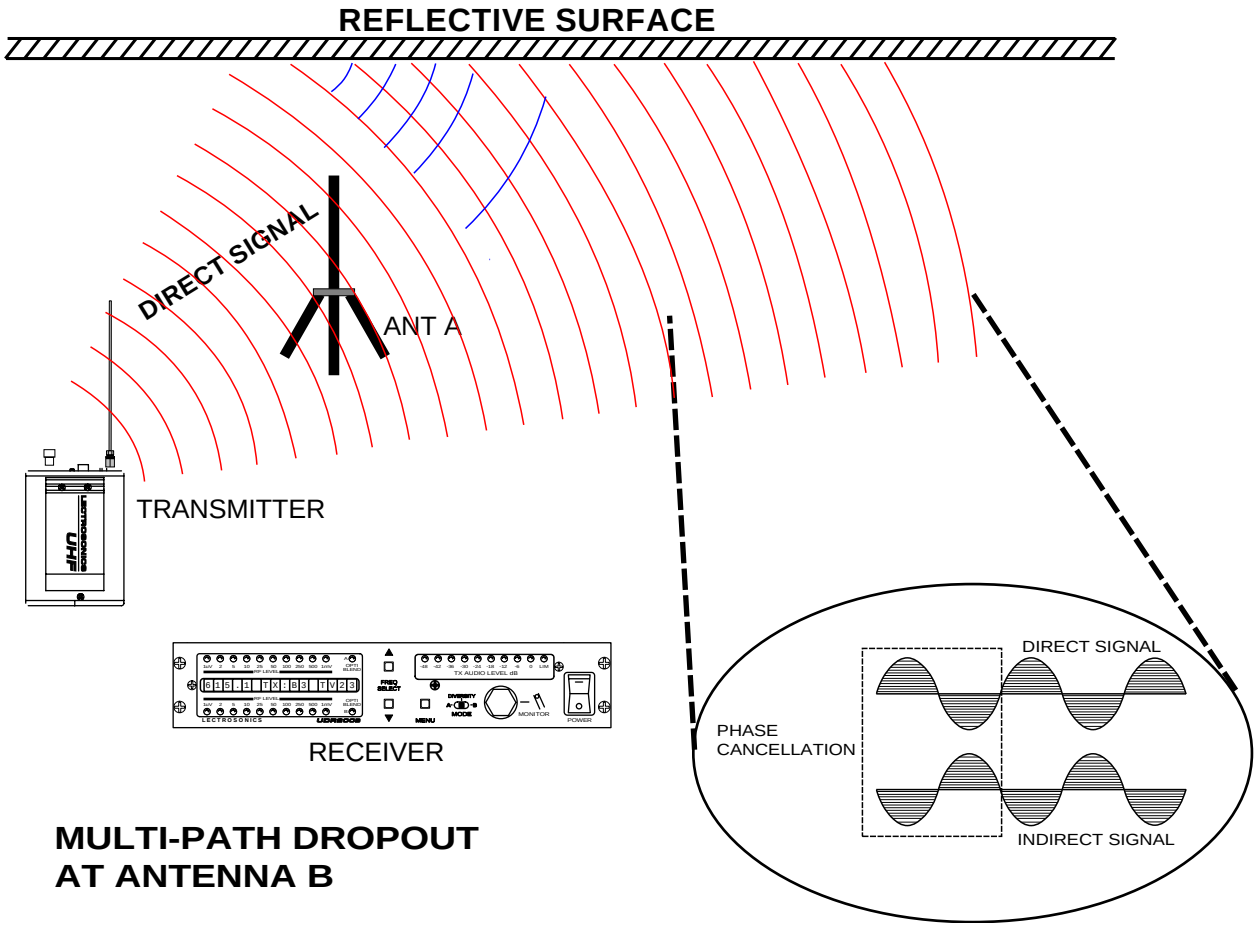
ANTENNA USE AND PLACEMENT

When using a remote antenna with this receiver, position the antennas at least three or four feet apart and so that they are not within 3 or 4 feet of large metal surfaces. If this is not possible, try to position the antennas so that they are as far away from the metal surface as is practical. It is also good to position the receiver so that there is a direct "line of sight" between the transmitter and the receiver antenna. In situations where the operating range is less than about 100 feet, the antenna positioning is much less critical. The antennas can also be configured with one whip mounted directly onto the rear panel of the UDR200B receiver, and the other one mounted remotely.

A wireless transmitter sends a radio signal out in all directions. This signal will often bounce off nearby walls, ceilings, etc. and a strong reflection can arrive at the receiver antenna along with the direct signal. If the direct and reflected signals are out of phase with each other a cancellation may occur. The result would be a "drop-out." A drop-out sounds like either audible noise (hiss), or in severe cases, may result in a complete loss of the carrier and the sound when the transmitter is positioned in certain locations in the room. A drop-out normally sounds like "hiss" or a "swishing" sound. Moving the transmitter even a few inches will change the sound of the hum or hiss, or eliminate it. A drop-out situation may be either better or worse as the crowd fills and/or leaves the room, or when the transmitter or receiver is operated in a different location.

The UDR200B receiver offers a sophisticated diversity design which overcomes drop-out problems in almost any imaginable situation. In the event, however, that you do encounter a dropout problem, first try moving the antenna at least 3 or 4 feet from where it was. This may alleviate the drop-out problem on that antenna. If drop-outs are still a problem, try moving the antenna to an entirely different location in the room or moving the antennas in closer to the transmitter location. By observing the OPTI-BLEND LEDs on the front panel, you can determine which antenna is suffering weak signals.

Lectrosonics transmitters radiate power very efficiently, and the receivers are very sensitive. This reduces drop-outs to an insignificant level. If, however, you do encounter drop-outs frequently, call the factory or consult your dealer. There is probably a simple solution.



MULTI-PATH DROPOUT AT ANTENNA B

TROUBLESHOOTING

POWER SUPPLY AND FUSE

Display not lit or dimly lit

- AC power cord disconnected.
- External power supply disconnected or inadequate.
- Main power supply defective.
- The External DC power input is protected by an auto-reset polyfuse. Disconnect power and wait about 10 seconds for the fuse to reset.

Receiver won't turn off

- This is normal when the unit is being operated from external DC power.

PILOT TONE SQUELCH

The pilot indicator is the transmitter switch settings display. When solid on, it indicates that the audio has been turned on at the transmitter, and that the audio output on the receiver is enabled. (When the indicator is solid on, the audio is on.) When the indicator is blinking, the audio is muted.

PILOT indicator solid on, but no sound

- Audio output cable bad or disconnected. Try monitoring at the headphone output on the front panel. The headphone output signal is taken just ahead of the output transformer.
- AUDIO OUTPUT level set too low.

PILOT indicator blinking, but sound still comes through

- PILOT TONE BYPASS switch may have been pressed. Turn receiver power off and then back on again to reset the audio output relays.

PILOT indicator does not stop blinking when transmitter audio switch is turned on

- It takes several seconds for the relay to actuate the PILOT lamp. Turn the transmitter power and audio switches on and wait 2 to 5 seconds for the lamp to come on.

ANTENNAS AND RF SIGNAL STRENGTH

RF LEVEL is weak on one (or both) channels

- Antenna is disconnected or there is a bad connection
- Antenna may need to be moved or reoriented
- Improper length of antenna, or wrong antenna. UHF whip antennas should be about 3 to 5 inches long.
- Transmitter is 100kHz (one switch position) off from the receiver frequency.

One OPTI BLEND LED does not come on or is dimly lit

- DIVERSITY switch is set to one or the other channels. Needs to be in the center position for normal operation.
- Reverse the antennas on the rear panel inputs. If the opposite OPTI BLEND LED now indicates the same problem, there may be an antenna or cabling problem. Try repositioning the antenna(s).

AUDIO SIGNAL QUALITY

Poor signal to noise ratio

- Transmitter gain set too low
- Noise may not be in wireless system. Mute the audio signal at the transmitter and see if noise remains. If the noise remains, then turn the power off at the transmitter and see if it remains. If the noise is still present, then the problem is not in the transmitter.
- If noise is still present when the transmitter is turned off, try lowering the audio output level on the UDR200B rear panel and see if the noise lowers correspondingly. If the noise remains, the problem is not in the receiver.
- Receiver output does not match the input of the device it is feeding. Try increasing the output level of the UDR200B and lowering the input gain on the device the UDR200B is feeding.

Distortion

- Transmitter input gain too high. Check and/or readjust input gain on transmitter according to the LEDs on the transmitter and then verify the setting with the transmitter audio level LED strip on the UDR200B front panel.
- Audio output level too high for the device the UDR200B is feeding.
- Transmitter is 100kHz (one switch position) off from the receiver frequency.

UDR200B REPLACEMENT PARTS and ACCESSORIES

Part No.	Description
A500RA	Right angle, flexible whip UHF antenna
21499	Replacement AC power cord
RMP200-1	Rack mount kit for single UDR200B receiver
RMP200-2	Rack mount kit for two UDR200B receivers
Optional Remote Antennas	
AY3U-550	3-element YAGI, +4.5dBD, 500 to 600 MHz range
AY3U-650	3-element YAGI, +4.5dBD, 600 to 700 MHz range
AGPU	UHF ground plane, 470 to 608 MHz range

SERVICE AND REPAIR

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

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

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

RETURNING UNITS FOR REPAIR

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

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

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

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

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

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

Shipping address:
Lectrosonics, Inc.
581 Laser Rd.
Rio Rancho, NM 87124
USA

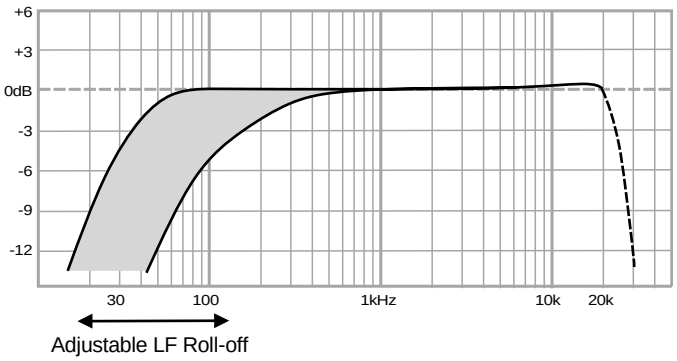
Telephones:
Regular: (505) 892-4501
Toll Free (800) 821-1121
FAX: (505) 892-6243

World Wide Web: *http://www.lectrosonics.com* ***Email:*** *sales@lectrosonics.com*

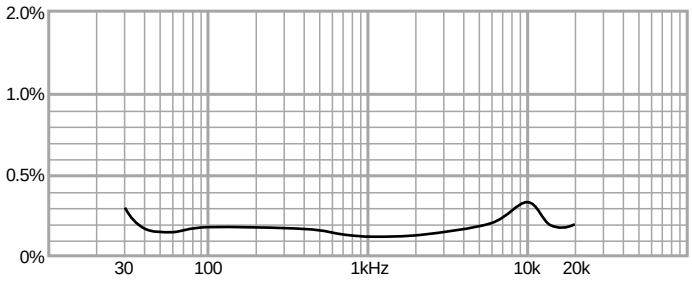
SPECIFICATIONS AND FEATURES

Operating Frequencies:	537.600 to 588.700 MHz; 614.400 to 793.500 MHz
Frequency Adjustment Range:	25.5 MHz
Receiver Type:	Dual conversion, superheterodyne, 71MHz and 455kHz
Frequency Stability:	±0.002 %
Front end selectivity:	>22 dB at ±4 MHz
Sensitivity	
20 dB Sinad:	0.707 uV (-110 dBm), A weighted
60 dB Quieting:	1.0 uV (-107 dBm), A weighted
Squelch quieting:	Greater than 125 dB
AM rejection:	Greater than 60 dB, 2 uV to 1 Volt (Undetectable after processing)
Modulation acceptance:	>90 kHz
Image and spurious rejection:	>100 dB
Third order intercept:	+12 dBm
Diversity technique:	Ratio diversity. Dual simultaneous receivers with dynamic audio combining (Opti-blend).
FM Detector:	Digital Pulse Counting Detector operating at 455kHz
Antenna inputs:	Dual BNC female; 50 Ohm impedance
Audio outputs	
Rear Panel XLR:	600 Ohm Balanced, transformer isolated, adjustable from -40 dBu to +20 dBu in 5 dB steps, at 60 kHz deviation
Monitor out:	Front panel ¼" Phone jack, adjustable from 0 to 635 mV RMS into 8 Ohms at 60 kHz deviation; 0 to 5.7V RMS into 600 Ohms at 60 kHz deviation.
Front Panel Controls and Indicators:	Power on/off switch and LED; Dual 10 segment RF signal level display; 10 segment transmitter audio level display; Multifunction LED graphic display; Up/Down/Menu buttons; Diversity operation selector switch; Opti-Blend operation LEDs; Monitor output jack and level control.
Rear Panel Controls and features:	Ant A and Ant B BNC connectors; Pilot tone bypass switch; Audio phase reversal switch; Noise filter mode switch; XLR audio output jack and 12-step audio attenuator; External DC input; 95 to 240 VAC input jack.
Power Options:	95 to 240 VAC, 50/60 Hz, 10 Watts 12 to 26 VDC, 10W total
Weight:	3 lbs, 14 ozs
Dimensions:	8.2" wide x 1.73" high x 10.6" deep

Typical System Frequency Response



Typical System THD + Noise



Specifications subject to change without notice

LecNet SOFTWARE PROTOCOL

Note: This section is for developement of custom control applications and is not necessary for general operation of the receiver and the LecNet control software provided by the factory.

The UDR200B uses a modification of the typical one-to-one connection between two RS-232 compatible devices. The UDR200B has both an RS-232 transmitter and receiver section. The transmitter section is "tri-stated", or placed in a high impedance mode, until the particular device is addressed. To facilitate the simple parallel connection of multiple devices on a single RS-232 port, an addressing scheme is employed to route commands from the host to the proper device. When a device receives its address from the host computer, it temporarily turns on its RS-232 transmitter long enough to send whatever data is requested by the host. In this way, multiple devices may drive a single transmit signal back to the host, because only the addressed UDR200B will turn on its transmitter.

The following code fragment, in BASIC, would be used to get an "Acknowledge" name string back from an UDR200B:

Valid address values are 128-254 (80h-FEh). 255 (FFh) is an invalid address and must not be used. Because the UDR200B will interpret any single data byte whose value is greater than 127 as an address, single byte data (as opposed to addresses) sent from the host must be in the range of 0-127. If a data value needs to be output that exceeds 127, two bytes are output such that the first byte is the lower 7 bits of the 8 bit value, and the second byte is 1 if the MSB of the data byte is 1, or 0 if the MSB of the data byte is 0 (see the Two Byte Format guidelines below).

Every UDR200B command must be preceded by the address of the device to be controlled. If a device with the requested address exists on the system, it will respond by sending a "0" back to the host.

```
OPEN "COM1:9600,N,8,1" FOR RANDOM AS #1 LEN = 25      'Open Com1:9600, N, 8, 1.
...
...
PRINT #1, CHR$(150)                                   'Output the device address.  Default address of
                                                      'UDR200B is 150.
DataByte% = ASC(INPUT$(1,#1))                         'Receive "0" byte.  The ASC function is used to convert
                                                      'the received string data to numeric data.
PRINT #1, CHR$(1)                                     'Output the "Acknowledge" command.

DataByte% = ASC(INPUT$(1,#1))                         'Receive the length of the acknowledge string
                                                      '(7 for the UDR200B).
Name$ = INPUT$(DataByte%,#1)                          'Receive the name string ("UDR200B")
```

The first PRINT and INPUT$ sequence must precede every command sent, even if the command is sent to the same UDR200B as the previous command. Thus, each interchange with an UDR200B follows this pattern:

1) Host sends device address (1 byte);
2) Host receives byte of “0” from UDR200B as acknowledgement;
3) Host sends command (1 byte) to UDR200B;
4) Host and UDR200B interact based on particular command sent.

This process must be followed for every command that is sent to the LecNet device. The implication here is that even if the host sends several commands to the same device, each command must be preceded by the LecNet address/acknowledge byte exchange.

LecNet SOFTWARE PROTOCOL

Two Byte Format for Data sent from Host

When the host must send data to a LecNet device whose value exceeds 127, the data must be broken into two successive bytes. This avoids having other LecNet devices interpret the host data as an address, since the address space is 128-254. If the host must send a data value that exceeds 127, two bytes are output such that the first byte is the lower 7 bits of the 8 bit value. The second byte is 1 if the original data value is greater than 127, and 0 otherwise.

UDR200B Serial Commands

The following is a listing of available commands grouped based on the UDR200B function to which the commands are related. The word "Host" in the command descriptions means the IBM PC, PC compatible, or other control system (like AMX or Crestron) to which the UDR200B is connected. In any commands where the host must send data to the UDR200B whose value can legitimately exceed 127, refer to the Two Byte Format guidelines above.

General Device Commands

Acknowledge - Causes the UDR200B sends its "name" string back to the host.

Host sends command - 1

Host receives 7 data bytes: Byte 1 is the number of bytes in the name string (7 for the UDR200B), followed by the ASCII characters "UDR200B".

Change Device Address - Changes the UDR200B device address and stores the new address in EEPROM.

Host sends command - 2
Host sends data byte: new device address, valid range 128 to 254.

Output Firmware Version - Outputs the version number of the current firmware. For example, Version 1.0 software would be returned as 10.

Host sends command - 25
Host receives data byte: firmware version.

Set Local/Remote Mode - Allows the Local/Remote status of the UDR200B to be set. 0 is Local mode, 1 is Remote. The Local/Remote setting is volatile, and the power-up default is Local.

Host sends command - 30
Host sends data byte: Status data (0 or 1 as above)

Other Commands

Output Receiver Block Number - Outputs the block number of the receiver.

Host sends command - 4
Host receives data byte: Block number 19 - 30

Output Current Receiver Frequency - Outputs the current frequency of the receiver.

Host sends command - 6
Host receives data byte: Current frequency 0 - 255.

(note: the actual frequency may be calculated as: block number x 25.6 MHz + current frequency x .1 MHz)

Set Current Receiver Frequency - Allows the current frequency for the receiver to be set. Also allows the option of storing the new frequency in non-volatile memory. If the new frequency is not stored, the receiver will revert to the last saved frequency on next power up.

Host sends command - 5
Host sends two data bytes: Bytes 1 and 2: New frequency, 0 - 255 Byte 3: 1 - Store new frequency in non-volatile memory, 0 - no store.

Output Operational Status - Outputs the current operational status of the receiver.
Host sends command - 8
Host receives data byte: Status, 0 - 2. 0 - Hard Locked, 1- Unlocked, 2 - Locked.

Set Operational Status - Allows the current operational status of the receiver to be set. The new status value is stored in non-volatile memory.

Host sends command - 7
Host sends data byte: Status, 0 - 2. 0 - Hard Locked, 1 - Unlocked, 2 - Locked.

Output Current Group Number - Outputs the current group number of the receiver.

Host sends command - 10
Host receives data byte: Group number, 1 - 4.

Set Current Group Number - Allows the current group number of the receiver to be set. The new group number is stored in non-volatile memory.

Host sends command - 9
Host sends data byte: Group number, 1 - 4.

Output Number of Group Entries in a Specified Group - Outputs the number of name/frequency entries in a specified group stored in non-volatile memory.

Host sends command - 16
Host sends data byte: Group (1 - 4) for which the number of entries is desired.
Host receives data byte: Number of entries, 0 - 16. 0 entries means the group is currently unused.

Set Number of Group Entries in a Specified Group - Allows the number of name/frequency entries to be set. The new number is stored in non-volatile memory.

Host sends command - 15
Host sends data bytes: Byte 1: Group number, 1 - 4. Byte 2: Number of entries in the group, 0 - 16.

Output Group Frequency and Name - Outputs specific name/frequency entries stored in non-volatile memory. Each of the entries, up to a total of 16 in each group, consists of 14 bytes. The first byte is the frequency, and the next thirteen are the name associated with that frequency.

Host sends command - 18
Host sends data bytes: Byte 1: Group number to down load to, 1 - 4. Byte 2: Group entry number, 1 - 16.
Host receives data bytes: Byte 1: Frequency, 0 - 255
Bytes 2 - 14: Name

Set Group Frequency and Name - Allows specific name/ frequency associations to be entered in non-volatile memory. Each of the entries, up to a total of 16 in each group, consists of 14 bytes. The first byte is the frequency, and the next thirteen are the desired name to associate with that frequency. The name may consist only of capital letters A-Z, numerals 0-9, and spaces. All thirteen name bytes must be sent, and if the name is less than 13 characters long. simply pad it with trailing spaces (ASCII 32). Note that it is prohibited to have two or more names associated with the same frequency in a group. In other words, all frequency entries in a given group must be unique in that group. This does not preclude having the same frequency in another group.

Host sends command - 17
Host sends data bytes:
Byte 1: Group number to download to, 1 - 4.
Byte 2: Group entry number, 1 - 16.
Bytes 3 and 4: Frequency, 0 - 255
Bytes 5 - 17: Name, can only be ASCII characters A-Z, 0-9, and space.
Host receives data byte: 100, to signify that the data has been stored in non-volatile memory.

Output Audio Modulation - Outputs the current audio modulation level. A returned value of 120 is equivalent to a 0dB modulation level (as indicated on the front panel Audio modulation meter). Values greater than 170 indicate Limiting.

Host sends command - 27
Host receives data byte: Audio modulation level, 0 - 255.

Output RF Levels - Outputs the current RF level of channels A and B. Data values range from 0 - 255, where 0 equals 1uV (-107dBm) and 255 equals 1mV (-47dBm). The RF level in dBm can be calculated as RF Level in dBm = -107 + Data value x .235.

Host sends command - 35
Host receives data bytes: Byte 1: RF Level Channel A, 0 - 255. Byte 2: RF Level Channel B, 0 - 255

Output Pilot Tone Status - Outputs the receiver status with respect to whether a valid pilot tone is detected.

Host sends command - 34
Host receives data byte: Pilot status, 0 - No pilot tone, 1 - Pilot tone present

Output Battery Status - Outputs the battery status of the associated transmitter, if the transmitter is on and the receiver recognizes the transmitter's pilot tone.

Host sends command - 62
Host receives data byte: Battery status, range between 0 and 28. The following list gives the actual battery voltage associated with each status number.

0 - Greater than 9.2V (or not available because the transmitter is not on or the pilot tone is not valid)

1 - Greater than 9.2V (or not available because the transmitter is not on or the pilot tone is not valid)
2 - 9.2V
3 - 9.1V
4 - 9.0V
5 - 8.8V
6 - 8.7V
7 - 8.6V
8 - 8.5V
9 - 8.4V
10 - 8.3V
11 - 8.1V
12 - 8.0V
13 - 7.9V
14 - 7.8V
15 - 7.7V
16 - 7.6V
17 - 7.5V
18 - 7.4V
19 - 7.4V
20 - 7.3V
21 - 7.2V
22 - 7.2V
23 - 7.0V
24 - 6.8V
25 - 6.7V
26 - 6.6V
27 - 6.5V
28 - Less than 6.5V (i.e. Dead)

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

This warranty applies only to items returned to us, shipping costs prepaid, within one year from the date of purchase.

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

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September 23, 1999