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LECTROSONICS IFBT4-VHF Frequency-Agile Compact IFB Transmitter Instruction Manual

Contents

LECTROSONICS IFBT4-VHF Frequency-Agile Compact IFB Transmitter

Introduction

This version of the IFB "base station" transmitter operates in the television broadcast band from 174 to 216 MHz (US TV channels 7 through 13). It will tune across the entire band, so clear frequencies can be found almost anywhere.

The VHF spectrum has not been impacted by the spectrum auctions and re-packing as much as the UHF spectrum, so the idea behind this product design is to operate an IFB system in the VHF band and free up space for wireless microphones in the UHF band. The IFBT4 features a graphics-type backlit LCD display with a menu system similar to those provided on other Lectrosonics receivers. The interface can be Locked to prevent a user from changing any settings but still allow browsing of the current settings. The unit can be powered from any external DC source of 6 to 18 Volts at 200 mA or from the provided 12 Volt power supply with a locking power connector. The pow-er inlet has an internal self-resetting fuse and reverses polarity protection. The housing is constructed of machined aluminum extrusion with a durable electrostatic powder coating. The front and rear panels are machined aluminum with an anodized finish and laser-etched engraving. The included antenna is a right angle, ¼ wavelength whip with a BNC connector.

Audio Input Interface

The standard 3 pin XLR connector on the rear panel handles all audio inputs. The four DIP switches allow setting the input sensitivity for low levels, such as mi-crophone inputs, or for high level line inputs, balanced or unbalanced. The switches also offer special settings to provide the proper input configurations to match to Clear Com, RTS1, and RTS2 intercom systems. Pin 1 of the XLR input connector is normally connected to ground but an internal jumper can be moved if a float-ing input is desired. Phantom supplied microphones may be connected without the need for DC isolation at the input of the transmitter. A user-selectable low-frequency roll-off can be set for 35 Hz or 50 Hz as needed to suppress low frequency acoustic noise or to extend the frequency response.

DSP-controlled Input Limiter

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

IFBT4-VHF Transmitter Block Diagram
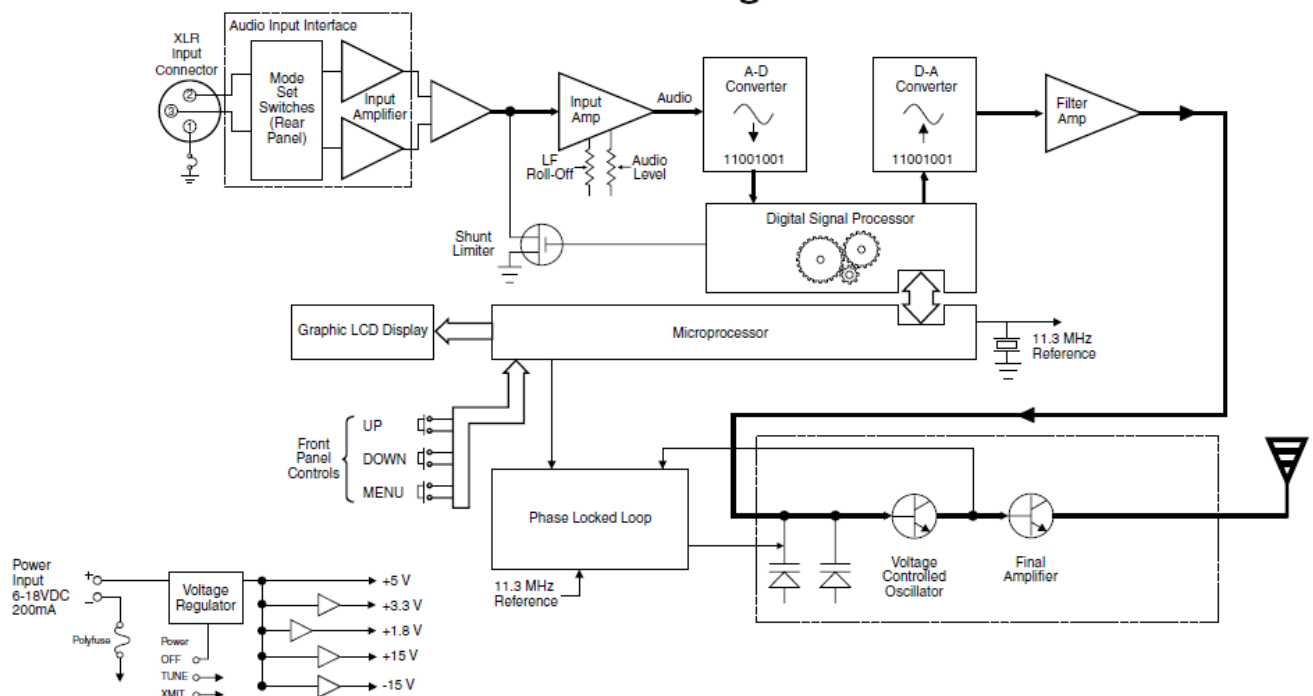
Digital Hybrid Wireless® Technology

Conventional analog systems use compandors for enhanced dynamic range, at the cost of subtle artifacts (known as "pumping" and "breathing"). Wholly digital sys-tems defeat the noise by sending the audio information in digital form, at the cost of some combination of power, bandwidth and resistance to interference.

Lectrosonics Digital Hybrid Wireless® systems over-come 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 informa-tion via an analog FM wireless link. This proprietary algorithm is not a digital implementation of an analog compandor but a technique that can be accomplished only in the digital domain, even though the inputs and outputs are analog.

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

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

Audio Signal Processing

Lectrosonics IFB systems use a single band compan-dor and pre-emphasis/de-emphasis to reduce noise. This signal processing is generated and applied by the DSP for accuracy and clean handling of signal dynamics. The DSP also provides the ability to employ compatibility modes for use with other wireless equipment in the VHF spectrum that may come along in the future.

Pilot Tone Squelch System

Lectrosonics IFB systems use a supersonic "pilot tone" to control the squelch activity in the receiver. A valid RF signal will include the pilot to signal the audio output to open. Even strong interference on the same frequency cannot open the audio output if the pilot tone is not present. During normal operation, an IFB receiver will listen for the distinctive pilot tone, remaining silent (squelched) until the pilot tone is detected. The pilot tone is located well above audio frequencies and is never passed through to the receiver's audio output.

Frequency Agility

The IFBT4 transmitter uses a synthesized, frequency selectable main oscillator. The frequency is extremely stable over a wide temperature range and over time. The transmitter's standard tuning range covers 239 frequencies from 174 to 216 MHz in 175 kHz steps. to alleviate interference problems in mobile applications.

Power Delay

When powering the transmitter on and off, and when switching between the XMIT and TUNE modes, intel-ligent circuitry adds brief delays in order to allow time for circuits to stabilize, both locally and in the match-ing receiver. These delays prevent clicks, thumps and other noise in the audio.

Microcontroller

The microcontroller oversees most system operations, including RF frequency and output, DSP audio functions, buttons and display, and more. User settings are stored in non-volatile memory, so they are retained even when the power is turned off.

Transmitter

The transmitter operates at the maximum allowed RF power level to ensure a clean signal free of dropouts and

noise. All transmitter circuits are buffered and filtered for excellent spectral purity. The clean trans-mitted signal reduces the chances for interference in multiple transmitter installations.

Antenna Port

The 50 Ohm BNC output connector will work with stan-dard coaxial cabling and remote antennas.

Front Panel Controls and Functions

- **OFF/TUNE/XMIT Switch**
    - OFF Turns the unit off.

      TUNE Allows all functions of the transmitter to be set up, without transmitting. The operating frequency may only be selected in this mode.
    - XMIT Normal operating position. The operating frequency may not be changed in this mode, though other settings may be changed, so long as the unit isn't "Locked."
- **Power-Up Sequence** When power is first turned on, the front panel LCD display steps through the following sequence.
    - Displays Model and the firmware version (e.g. IFBT4VHF and V1.0).
    - Displays the current compatibility mode setting (e.g. COMPAT IFB).
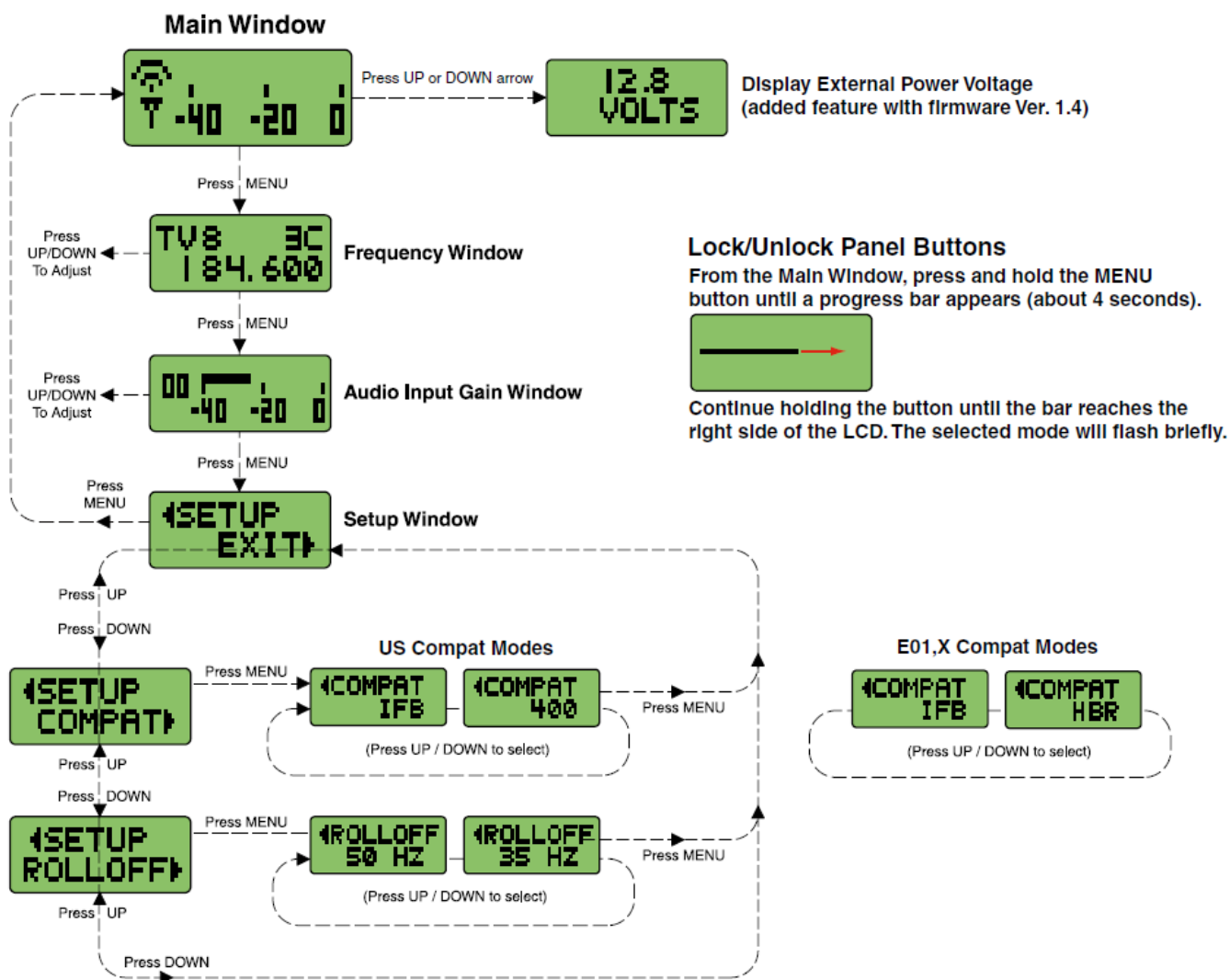   - Displays the Main Window.
- **Main Window** The Main window is dominated by an audio level meter, which displays the current audio modulation level in real-time. In TUNE mode, a blinking capital "T" is displayed in the lower-left corner to remind the user that the unit is not yet transmitting. In XMIT mode, the blinking "T" is replaced by an antenna icon. Audio limiting is indicated when the audio paragraph extends all the way to the right and widens somewhat. Clipping is indicated when the zero in the lower right corner changes to a capital "C". The Up and Down buttons are disabled in this Window.
- **Frequency Window** Pressing the MENU button once from the Main window navigates to the Frequency window. The Frequency window displays the current operating frequency in MHz, as well as the standard Lectrosonics hex code. Also displayed is the UHF television channel to which the selected frequency belongs. In XMIT mode, it is not possible to change the operating frequency. In TUNE mode, the Up and Down buttons may be used to select a new frequency. The UP and DOWN buttons navigate in 175 kHz increments. Holding the MENU butto+Up and MENU+Down move 2.8 MHz at a time. In any of the various group tun-ing modes, the currently selected group identifier is displayed to the left of the hex code, and the Up and Down buttons navigate among the frequencies in the group. In factory group tuning modes A thru D, MENU+Up and MENU+Down jump to the highest and lowest frequencies in the group. In user group tuning modes U and V, MENU+Up and MENU+Down permit access to frequencies not currently in the group. Pressing and holding the Up or Down button invokes an autorepeat function, for faster tuning.
- **Audio Input Gain Window** Pressing the MENU button once from the Frequency window navigates to the

Audio Input Gain window. This window greatly resembles the Main window, with the exception that the current audio input gain setting is displayed in the upper left corner. The Up and Down buttons may be used to alter the setting while reading the real-time audiometer to determine what setting works best. The gain range is -18 dB to +24 dB with 0 dB nominal center. The reference for this control can be changed with the rear panel MODE switches. See the Installation and Operation section for more information on the MODE switches.

- **Setup Window** Pressing the MENU button once from the Audio Input Gain window navigates to the Setup window. This window provides access to a menu for various setup screens.

  Initially, the active menu item is EXIT. Pressing the Up and Down keys permits navigation to the menu items: COMPAT and ROLLOFF. Pressing the MENU button selects the current menu item. Selecting EXIT navigates back to the Main window. Selecting any other item navigates to the associated setup screen.

- **ROLL OFF Setup Screen** The ROLLOFF setup screen controls the low-frequency audio response of the IFBT4 by moving the 3 dB corner of a 4 pole lowpass digital filter. The 50 Hz setting is the default, and should be used whenever wind noise, HVAC rumble, traffic noise or other low-frequency sounds may degrade the quality of the audio. The 35 Hz setting may be used in the absence of adverse conditions, for fuller bass response. Press MENU to return to the Setup window.

- **COMPAT Setup Screen** The COMPAT setup screen selects the current compatibility mode, for interoperation with various types of receivers. The available modes are:

    - **US Nu Hybrid –** This mode offers the best audio quality and is recommended if your receiver supports it.
    - **IFB –** Lectrosonics IFB compatibility mode. This is the default setting and is the appropriate setting to use with the Lectrosonics IFBR1A or a compatible IFB receiver.

      NOTE: If your Lectrosonics receiver does not have Nu Hybrid mode, use Euro Digital Hybrid Wireless® (EU Dig. Hybrid).
    - **E01, X IFB –** Lectrosonics IFB compatibility mode. This is the default setting and is the appropriate setting to use with the Lectrosonics IFBR1A or a compatible IFB receiver.

- **HBR –** Digital Hybrid Mode. This mode offers the best audio quality and is recommended if your receiver supports it. Press MENU to return to the Setup window.

- **Lock/Unlock Panel Buttons** To enable or disable the control panel buttons, navigate to the Main Window and press and hold the MENU button for about 4 seconds. Continue holding the button as a progress bar extends across the LCD. When the bar reaches the right side of the screen, the unit will toggle to the opposite locked or unlocked mode.

Main Window

Press UP or DOWN arrow

Display External Power Voltage
(added feature with firmware Ver. 1.4)

12.8 VOLTs

Press MENU

Press UP/DOWN To Adjust

TV8 3C
184.600 **Frequency Window**

Press MENU

Press UP/DOWN To Adjust

00
-40 -20 0 **Audio Input Gain Window**

Press MENU

Press MENU

◀SETUP EXIT▶ **Setup Window**

Lock/Unlock Panel Buttons
From the Main Window, press and hold the MENU button until a progress bar appears (about 4 seconds).

Continue holding the button until the bar reaches the right side of the LCD. The selected mode will flash briefly.

Press UP
Press DOWN

◀SETUP COMPAT▶

Press MENU

US Compat Modes

◀COMPAT IFB   ◀COMPAT 400
Press MENU
(Press UP / DOWN to select)

Press UP
Press DOWN

◀SETUP ROLLOFF▶

Press MENU

◀ROLLOFF 50 HZ   ◀ROLLOFF 35 HZ
Press MENU
(Press UP / DOWN to select)

Press UP
Press DOWN

E01,X Compat Modes

◀COMPAT IFB   ◀COMPAT HBR
(Press UP / DOWN to select)

Rear Panel Controls and Functions

IFBT4-VHF Rear Panel

XLR Jack A standard XLR female jack accepts a variety of input sources depending on the setting of the rear panel MODE switches. XLR pin functions can be changed to suit the source depending on the positions of the indi-vidual switches. For detailed information on the setting of these switches see the Installation and Operation section.

Power Input Connector The IFBT4 is designed to be used with the CH20 external (or equivalent) power source. The nominal voltage to operate the unit is 12 VDC, although it will operate at voltages as low as 6 VDC and as high as 18 VDC. External power sources must be able to supply 200 mA continuously. The connector dimensions are shown below. Lectro-sonics P/N 21425 has a straight back shell. P/N 21586 has a locking collar.

.375" to .475" typ.

Straight or with locking collar

.215 O.D. .075" I.D.

Center pin (+)
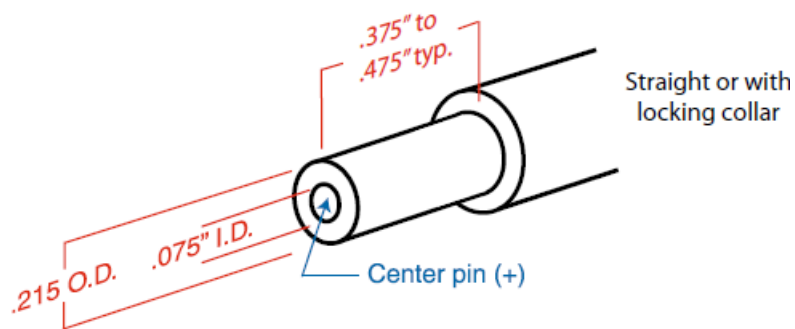
Input Configuration (Mode Switches) The MODE switches allow the IFBT4 to accommodate a variety of input source levels by changing the input sensitivity and the pin functions of the input XLR jack. Marked on the rear panel are the most common set-tings. Each setting is detailed below. Switches 1 and 2 adjust the XLR pin functions while switches 3 and 4 adjust the input sensitivity.

Name	Switch Positions 1 2 3 4	XLR Pins	Balanced	Input Sensitivity
CC	▼ ▼ ▼ ▲	3 = Audio 1 = Common	No	-10 dBu
MIC	▲ ▲ ▲ ▼	2 = Hi 3 = Lo 1 = Common	Yes	-42 dBu
LINE	▲ ▲ ▼ ▼	2 = Hi 3 = Lo 1 = Common	Yes	0 dBu
RTS1	▲ ▼ ▼ ▼	2 = Hi 1 = Common	No	0 dBu
RTS2	▼ ▼ ▼ ▼	3 = Hi 1 = Common	No	0 dBu

Installation and Operation

1. The IFBT4 transmitter is shipped with pin 1 of the XLR input connector tied directly to ground. If a floating input is desired, a Ground Lift Jumper is provided. This jumper is located inside the unit on the PC board near the rear panel XLR jack. For floating input, open the unit and move the Ground Lift Jumper to the outermost contacts.

Location of Ground Lift Jumper:

Jumper placed toward PCB as shown connects
pin 1 to ground. Move jumper to outside
contacts to lift ground.

2. Set the MODE switches on the rear panel to match the specific input source to be used. See Input Configuration (Mode Switches).

3. Insert the power supply plug into the 6-18 VDC jack on the rear panel.

4. Insert the microphone or other audio source XLR plug into the input jack. Ensure that the pins are aligned and that the connector locks into place.

5. Attach the antenna (or antenna cable) to the BNC connector on the rear panel.

6. Set the OFF/TUNE/XMIT switch to TUNE.

7. Press the MENU button to display the Frequency Window and adjust the transmitter to the desired frequency with the front panel Up and Down but-tons.

8. Position the microphone. The microphone should be placed where it will be located during actual use.

9. Use the MENU button to navigate to the Audio Input Gain Window. While speaking at the same voice level that will be present during actual use, observe the audio meter display. Use the Up and Down buttons to adjust the audio input gain so that the meter reads close to 0 dB, but only rarely exceeds 0 dB (limiting).

10. Once the transmitter audio gain has been set, the receiver and other components of the system can be turned on and their audio levels adjusted. Set the power switch on the IFBT4 transmitter to XMIT and adjust the associated receiver and sound system level as required.

Note: There will be a delay between the moment the transmitter is energized and the actual appearance of audio at the receiver output. This intentional delay eliminates turn-on thumps, and is controlled by the pilot tone squelch system.

Adjust Audio Input Level

The AUDIO LEVEL control adjusts the gain applied to the incoming audio signal. This gain adjustment is used to match the input level to the incoming signal from the sound source to provide full modulation and the maximum signal to noise ratio, not to set the volume of the associated receiver. If the audio level is too high, compression or distortion may occur. The audio level meter will reach the 0 dB level (full scale) frequently or remain indicating full scale. Input limiting begins when a vertical line appears at the right end of the level indicator.

Input limiting indicator

If the audio level is too low, the audio level meter will continuously indicate a low level. This condition may cause hiss and noise in the audio, or pumping and breathing in the background noise.

Low Input level
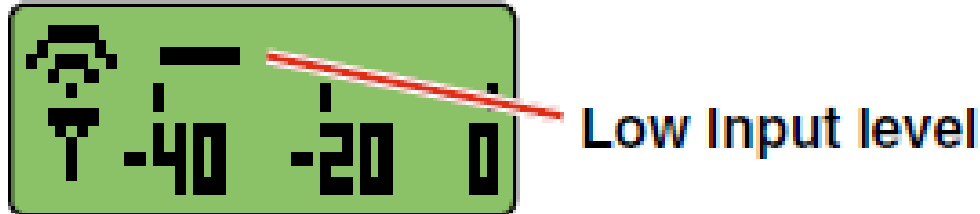
The input limiter will handle peaks up to 30 dB above full modulation, regardless of the gain control setting. Occasional limiting is often deemed desirable, indicat-ing that the gain is correctly set and the transmitter is fully modulated for optimum signal to noise ratio. Differ-ent voices will usually require different audio input gain settings, so check this adjustment as each new person uses the system. If several different people will be using the transmitter and there is not time to make the adjustment for each individual, adjust it for the loudest voice

Accessories

DCR12/A5U

A170AC

ARG15
ARG25
ARG50
ARG100

CCMINI

RMP195

21425

21472

21586

- **DCR12/A5U** AC power supply for IFBT4 transmitters; 100-240 V, 50/60 Hz, 0.3 A input, 12 VDC regulated output; 7-foot cord with LZR threaded locking plug and interchangeable blades/posts for use in Europe, UK, Australia and USA.
- **A170AC** VHF straight whip antenna; right angle BNC connector
- **ARG15** A 15-foot antenna cable of standard RG-58 coax cable with BNC connectors at each end. Loss of 1 to 2 dB with 0.25" diameter.
- **ARG25/ARG50/ARG100** An antenna cable of Belden 9913F low-loss coax cable with BNC connectors at each end. Double shielded, flexible, 50 Ohms, with a foamed polyethylene dielectric. Lower loss (1.6 to 2.3 dB) with somewhat less weight than standard RG-8 with the same 0.400" diameter. Available in 25, 50 and 100-foot

lengths.

- **CCMINI** A soft-sided, padded and zippered carrying case for compact wireless systems.
- **RMP195** 4 channel rack mount for up to four IFBT4 transmitters. Rocker switch included working as a master power switch if desired.
- **21425** 6 ft. long power cord; coaxial to stripped & tinned leads. Coaxial plug: ID-.080"; OD-.218"; Depth- .5". Fits all compact receiver models that use a CH12 power supply.
- **21472** 6 ft. long power cord; coaxial to stripped & tinned leads. Right angle coaxial plug: ID-.075"; OD-.218"; Depth- .375". Fits all compact receiver models that use a CH12 power supply.
- **21586** DC16A Pigtail power cable, LZR stripped & tinned.

Troubleshooting

NOTE: Always ensure that the COMPAT (compatibility) setting is the same on both transmitter and receiver. A variety of different symptoms will occur if the settings do not match.

Symptom: / Possible Cause:

Display Blank	1)	External power supply disconnected or inadequate.
	2)	The External DC power input is protected by an auto-reset polyfuse. Disconnect power and wait about 1 minute for the fuse to reset.
No Transmitter Modulation	1)	Audio input gain setting turned all the way down.
	2)	Sound source off or malfunctioning.
	3)	Input cable damaged or mis-wired.
No Received Signal	1)	Transmitter not turned on.
	2)	Receiver antenna missing or improperly positioned. (The IFBR1/IFBR1a headset cable is the antenna.)

	3)	Transmitter and receiver not on same frequency. Check on transmitter and receiver.
	4)	Operating range is too great.
	5)	Transmitter antenna not connected.
	6)	Transmitter switch in the TUNE position. Switch to XMIT mode.
No Sound (or Low Sound Level), and Receiver is powered on.		
	1)	Receiver output level set too low.
	2)	Receiver earphone cable is defective or mis-wired.
	3)	Sound system or transmitter input is turned down.
Distorted Sound	1)	Transmitter gain (audio level) is far too high. Check audio level meter on transmitter as it is being used. (Refer to Installation & Operation section for details on gain adjustment.)
	2)	Receiver output may be mismatched with the headset or earphone. Adjust output level on receiver to the correct level for the headset or earphone.

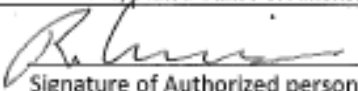|		
	3)	Excessive wind noise or breath "pops." Reposition microphone and/or use a larger windscreen.
Hiss, Noise, or Audible Dropouts	1)	Transmitter gain (audio level) far too low.
	2)	Receiver antenna missing or obstructed. (The IFBR1/IFBR1a headset cable is the antenna.)
	3)	Transmitter antenna missing or mismatched. Check that the correct antenna is being used.
	4)	Operating range too great.
	5)	Defective remote antenna or cable.

Specifications

- **Operating Frequencies (MHz): Available Frequencies: Channel Spacing:** 174.100 to 215.750 MHz
- **RF Power Output:** 239
- **Pilot tone:** 175 kHz
- **Spurious Radiation:** 50 mW
- **Modulation:** US: 25 to 32 kHz; 3.5 kHz deviation (in Nu Hybrid mode)
    - E01, X: 29.997 kHz IFB & 400 mode; each frequency has a unique pilot tone
    - US: Compliant with ETSI EN 300 422-1 v1.4.2 E01: Digital Hybrid Mode
    - Compliant with ETSI EN 300 422-2
- **Frequency Stability:** ±.001% (10 ppm) @ 25° C
- **Temperature Stability:** ±.001% (10 ppm) from -30° C to +50° C
- **Channel Selection:** Momentary pushbutton switches, tune Up and Down
- **Compatibility Modes:** US: IFB and Nu Hybrid E01, X: IFB and Digital Hybrid Wireless® (400 Series)
- **Audio Frequency Response:** US:
    - IFB Mode: 100 Hz to 8 kHz, ±1 dB
    - Nu Hybrid Mode: 30Hz to 20kHz ±1dB response (see Rolloff)
    - E01, X: IFB Mode: 100 Hz to 8 kHz, ±1 dB

- Digital Hybrid Mode: 30Hz to 20kHz ±1dB response (see Rolloff)
- **Rolloff:** Low frequency audio rolloff is menu selectable for 3 dB down at 35 Hz or 50 Hz. 50 ohms
- **Output Impedance:** dBu for Line, RTS1 & RTS2 -10 dBu for Clear Com
- **Audio Input Levels:** -42 dBu for mic dry inputs (no phantom power) +/-50Vdc max

Declaration of Conformity

Declaration of Conformity

In according with EN 45014

Manufacturer Name: (Or His authorized representative)	Lectrosonics, Inc.
Manufacturer Address: (Or His authorized representative)	581 Laser Road, N.E., P.O. Box 15900, Rio Rancho, NM 87124, United States of America

Declare under our sole responsibility that the product	
Product name:	Synthesized VHF IFB Transmitter
Model:	IFBT4/E01-VHF
Product option (if any):	

Is in conformity with the following standards or other normative documents

Test standards	Report number
EN 301-489-1:V1.9.2, EN 301-489-3: V1.6.1, EN 61000-3-2: 2014, EN 61000-3-3:2013	EMC_SL16011501-LEC-001_CE
EN 60065:2014	SL16011501-LEC-001
EN 62311: 2008	CE_Exposure_SL16011501-LEC-001
ETSI EN 300 422-2 V1.4.1 (2015-06)	CE_RF_SL16011501-LEC-001

We hereby declare that [all essential radio test suites have been carried out and that] the above named product is in conformity to all the essential requirement of Directive 1999/5/EC.

The conformity assessment procedure referred to in Article 10 and detailed in Annex [III] or [IV] of Directive 1999/5/EC has been followed with the involvement of the following Notified Body(ies):

SIEMIC Inc , 775 Montague Expressway , Milpitas , CA 95035 USA
Identification mark : CE2200

The Technical documentation relevant to the above equipment will be held at

Name :	Robert Cunnings
Title :	V.P. Engineering
Address:	581 Laser Road, N.E., P.O. Box 15900, Rio Rancho, NM 87124, United States of America
Date: 24 May 2016	Signature of Authorized person

Service and Repair

If your system malfunctions, you should attempt to correct or isolate the trouble before concluding that the equipment needs repair. Make sure you have followed the setup procedure and operating instructions. Check the interconnecting cables and then go through the Troubleshooting section in this manual.
We strongly recommend that you do not try to repair the equipment yourself and do not have the local repair shop

attempt anything other than the simplest repair. If the repair is more complicated than a broken wire or loose connection, send the unit to the factory for repair and service. Don't attempt to adjust any controls inside the units. Once set at the factory, the various controls and trimmers do not drift with age or vibration and never require readjustment. There are no adjustments inside that will make a malfunctioning unit start working. LECTROSONICS' Service Department is equipped and staffed to quickly repair your equipment. In warranty, repairs are made at no charge in accordance with the terms of the warranty. Out-of-warranty repairs are charged at a modest flat rate plus parts and shipping. Since it takes almost as much time and effort to determine what is wrong as it does to make the repair, there is a charge for an exact quotation. We will be happy to quote approximate charges by phone for out-of-warranty repairs.

Returning Units for Repair

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

- 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.

- 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.

- 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 ensure the equipment when we ship it back to you.

Documents / Resources

LECTROSONICS IFBT4-VHF Frequency-Agile Compact IFB Transmitter [pdf] Instruction Manual
IFBT4-VHF, Frequency-Agile Compact IFB Transmitter, IFBT4-VHF Frequency-Agile Compact IFB Transmitter

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