

TH1

ACTIVE TELEPHONE HYBRID MODULE

OPERATING INSTRUCTIONS and trouble-shooting guide

LECTROSONICS, INC.
Rio Rancho, NM

INTRODUCTION

The TH1 Active Telephone Hybrid provides a convenient way to use a Modular Audio Processing sound system for teleconferencing purposes. The TH1 works with any standard two wire telephone system. A powerful Digital Signal Processor (DSP) actively adjusts the line balance to achieve maximum transmit and receive signal separation. In addition, echo suppression based on Lectrosonics unique Adaptive Proportional Gain algorithm minimizes acoustic echo while maintaining near full-duplex operation.

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FCC PART 68 COMPLIANCE

This equipment complies with Part 68 of the FCC rules. On the rear panel of this equipment is a label that contains, among other information, the FCC registration number and ringer equivalence number (REN) for this equipment. If requested, this information must be provided to the telephone company.

This equipment uses the following USOC jacks: RJ11C

The REN is used to determine the quantity of devices which may be connected to the telephone line. Excessive REN's on the telephone line may result in the devices not ringing in response to an incoming call. In most, but not all areas, the sum of the REN's should not exceed five (5.0). To be certain of the number of the devices that may be connected to the line, as determined by the total REN's, contact the telephone company to determine the maximum REN for the calling area.

If this equipment causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. If advance notice isn't practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your rights to file a complaint with the FCC if you believe it is necessary.

The telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the operation of the equipment. If this happens, the telephone company will provide advance notice in order for you to make the necessary modifications in order to maintain uninterrupted service.

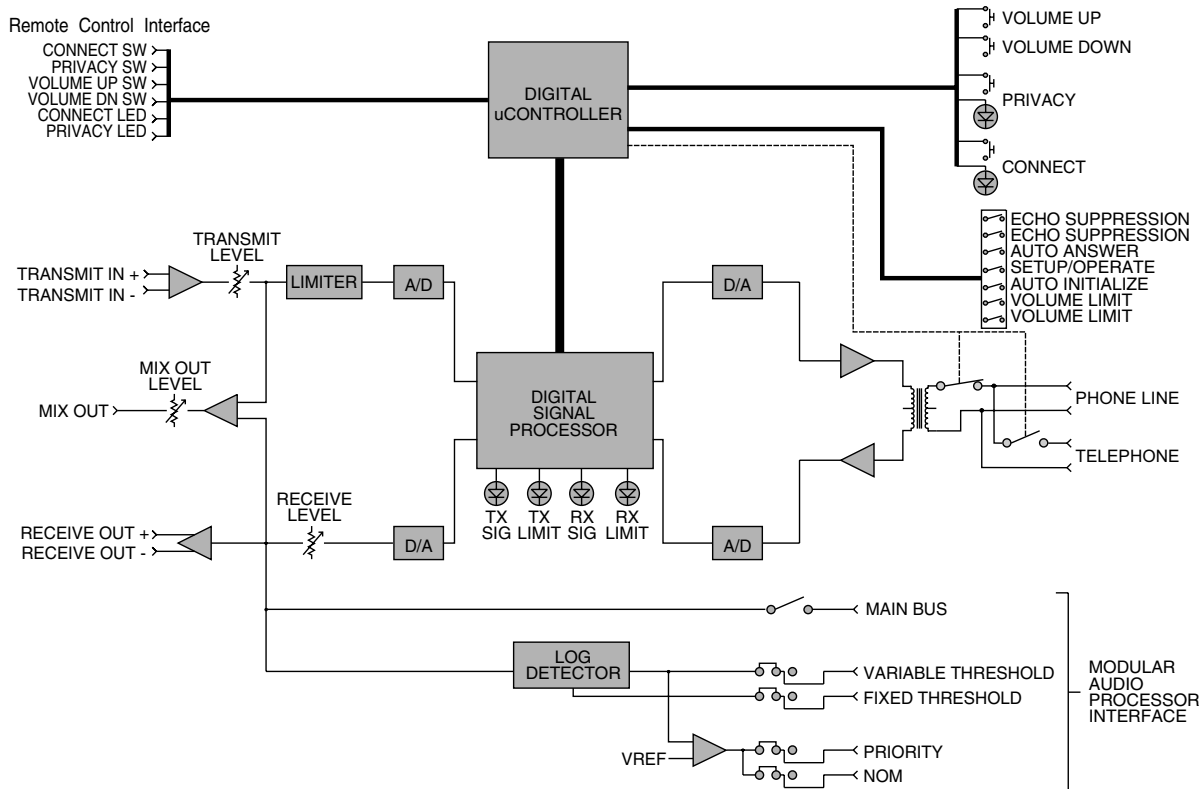
If trouble is experienced with this equipment, please contact Lectrosonics, Inc. at (800) 821-1121 for repair and/or warranty information. If the trouble is causing harm to the telephone network, the telephone company may request you remove the equipment from the network until the problem is resolved.

The following repairs can be done by the customer: No user serviceable parts inside.

This equipment cannot be used on telephone company-provided coin service. Connection to Party Line Service is subject to state tariffs.

GENERAL TECHNICAL DESCRIPTION

The TH1 is built around a powerful DSP microprocessor. The DSP performs all internal calculations using 24 bits, giving an internal dynamic range of 144dB. All A/D and D/A converters are 16-bit, sigma-delta types with 64 times oversampling. The DSP implements both the transmit/receive signal separation, as well as a sophisticated echo suppression algorithm. Please refer to the block diagram of the TH1 for the following discussion.



The Transmit (or near-end) signal is typically input from the Auxiliary output of the AC1 Controller module. The Transmit Level control allows adjustment of the transmit signal level for best operation. The transmit signal is passed through a very fast attack limiter prior to being digitized by the A/D converter. The transmit output signal is converted back to an analog signal by the D/A converter, buffered, and output to the phone line coupling transformer. Because of impedance mismatches between the transmit output driver, transformer, and phone line, some of the transmit signal recirculates through to the receive path. In a normal telephone handset, this recirculated transmit signal is known as a "sidetone". In teleconferencing applications, however, this sidetone signal can cause feedback or loss of intelligibility. For this reason, the DSP is programmed to remove any artifacts of the transmit signal from the receive (or far-end) signal.

Echo suppression is also programmed into the DSP. The Lectrosonics Adaptive Proportional Gain algorithm used for echo suppression dynamically varies the transmit and receive path gain in response to the signal level present in both paths. This helps prevent retransmission of a received signal, caused by acoustic coupling between near-end system loudspeakers and microphones. Because no abrupt gain changes are made, the perceived effect is a full duplex conversation.

INSTALLATION

Before installing the module, see the Operating Instructions section for guidance as to how to select the various jumperable options on the TH1.

The TH1 is installed from the rear of the Modular Audio Processor mainframe. Care should be taken when aligning the circuit board with the card guides. Once the module is aligned, slide the card forward in the mainframe until the female edge connector on the module seats firmly onto the male pins of the main bus board.

Four #4 machine screws are provided with the TH1 module. The two screws with captive washers are used to secure the rear panel to the top and bottom rails of the mainframe. After this is accomplished, fit the front panel (also supplied) over the front of the module and secure it, using the two flat-head #4 machine screws, to the front panel of the Modular Audio Processor mainframe. Once these four screws are in place, the installation is complete.

FRONT PANEL DESCRIPTION

RECEIVE LEVEL UP/DOWN - Adjusts the receive audio level. Operates in parallel to the remote Volume Up/Down buttons. The range of adjustment is set by the Volume Limit dipswitch settings. Note that the Connect LED will flash each time a change in volume (up or down) is made. This flashing will stop when the volume limits are reached.

PRIVACY - Mutes the transmitted audio to allow private conversations to take place. The phone connection is maintained.

CONNECT - Connects or disconnects the TH1 from the phone line. The Connect button is used to pick up an incoming call or to switch back and forth from the TH1 to a handset.

TX LEVEL - Adjusts the transmit volume level. The TX SIG LED indicates the presence of transmit signal, and the TX LIM LED indicates overload in the transmit channel.

RX LEVEL - Adjusts the receive volume level. The RX SIG LED indicates the presence of receive signal, and the RX LIM LED indicates overload in the receive channel.

DIPSWITCH OPTIONS - Figure 3 shows the dipswitch setting options for the TH1.

Echo Suppression - Selects the amount of echo suppression used. Auto is the normal setting. Auto uses the least echo suppression possible to achieve acceptable performance. Use the other settings as necessary if too much of the received signal is acoustically coupled back out the to the transmit signal.

Auto Answer - Selects whether the TH1 will automatically connect if it receives a phone call.

Setup/Operate - Selects the operational mode of the TH1. The Setup mode is usually used when the system is initially installed. Thereafter, the switch should always be left in the Operate mode.

Auto Initialize - Selects whether the TH1 will re-initialize every time it connects. If Auto Initialization is on, the far-end listener will hear a short noise burst as the TH1 resets its adaptive filter coefficients. If Auto Initialization is off, the adaptive filter coefficients stored from the system setup are used. The best performance will be obtained with Auto Initialization turned on.

Volume Limit - Selects the limitation placed on the volume adjustment range. This limitation only affects the front panel Receive Level pushbuttons, or the Receive Level pushbuttons of the remote control (if used).

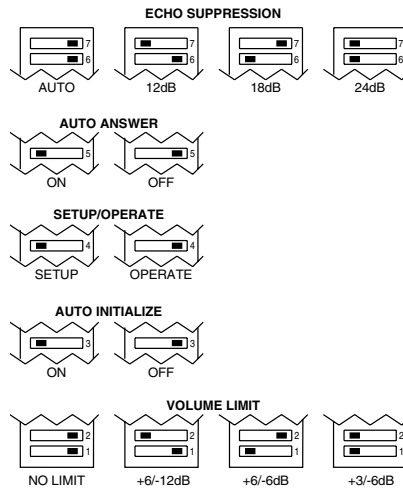


Figure 3 - TH1 Dipswitch settings

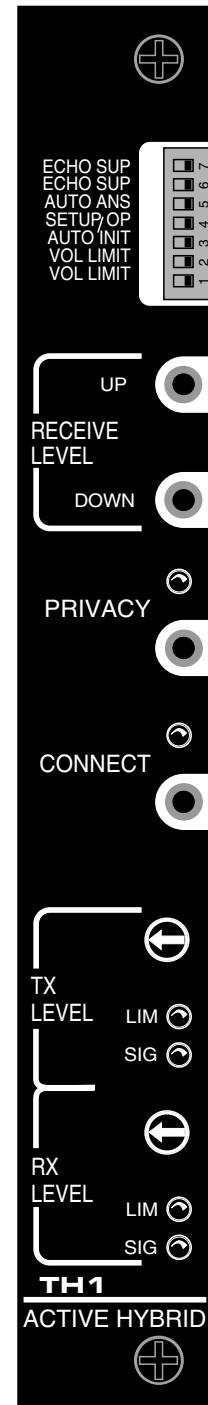


Figure 2 - TH1 Front Panel

REAR PANEL DESCRIPTION

REMOTE CONTROL - Allows the Connect, Privacy, Volume Up/Down, and indicator LEDs to be operated from a remote location. Figure 5 shows the connection diagram to the 9 pin D-Sub Remote Control connector.

MIX OUT LEVEL - Controls the audio level of the Mix Output. This output may be used for recording of the conference, etc.

IN(+), IN(-) - Accepts a balanced or unbalanced transmit input signal. Typically driven from the balanced Aux Output on the AC1 Controller Module.

OUT(+), OUT(-) - Outputs the received audio signal. This output is not normally used when the TH1 drives the MAP system Main or Aux bus.

MIX OUT - Provides an unbalanced signal consisting of a mix of the transmit and receive signals.

LINE - Accepts a standard two wire telephone line on an RJ-11 style connector.

PHONE - Accepts a standard RJ-11 style connector to enable a telephone to be used in conjunction with the TH1.

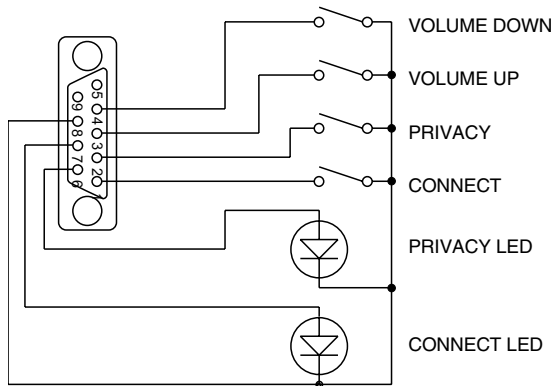


Figure 5 - TH1 Remote Control Connections

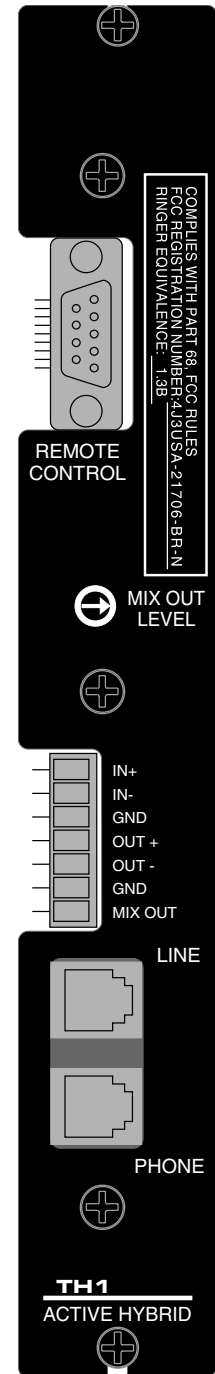


Figure 4 - TH1 Rear Panel

OPERATING INSTRUCTIONS

The following instructions assume that the TH1 will feed the Main bus of a MAP system, and that the Aux Output of the AC1 Controller module will feed the Transmit Input of the TH1. This is the standard setup for the TH1 when used with a sound system configured around the MAP system.

- 1) Refer to Figure 6 for the positions of the configurable jumpers. Note that if the TH1 is being used in the standard setup, no changes from the factory configuration will be necessary.

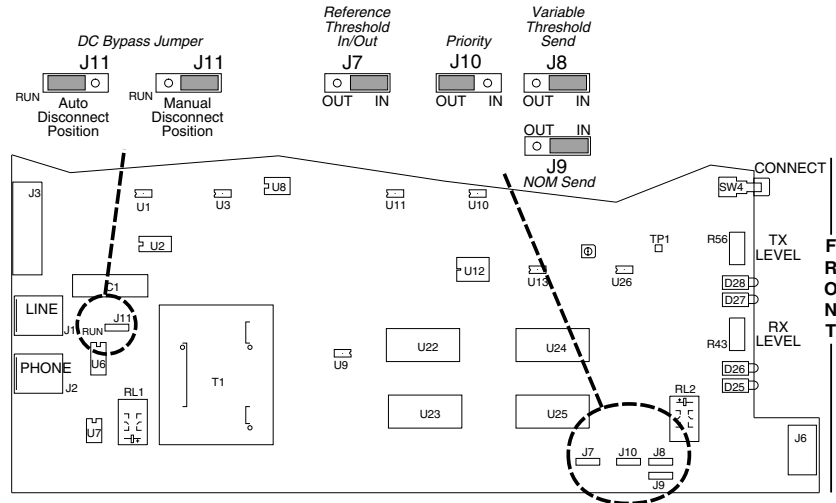


Figure 6 - TH1 Configurable Jumpers

- 2) Connect the telephone line to the LINE input RJ-11 jack. If a local telephone is to be used in conjunction with the TH1, connect it to the PHONE input RJ-11 jack. Note that to originate calls, a local phone must be connected to the system.

- 3) Connect the Aux Output of the AC1 to the IN(+), IN(-), and ground terminals of the TH1. Pin 2 of the Aux Output should connect to the IN(+) terminal, Pin 3 to the IN(-) terminal, and Pin 1 to GND.

- 4) Set the both TX LEVEL control and the RX LEVEL control to the mid position (9 o'clock). Set the Aux Output level control on the AC1 to the mid position.

- 5) Set the dipswitch options as desired. Factory settings are:

| | |
|------------------|----------|
| Echo Suppression | Auto |
| Auto Answer | On |
| Setup/Operate | Operate |
| Auto Init On | |
| Volume Limit | No Limit |

- 6) If a local phone is connected, originate a call to a remote site. If no local phone is present, someone at a remote site must call you. If you are the originating site, press the CONNECT button to connect the TH1 to the phone line after the call has been established. If the remote site originates the call, and Auto Answer is On, the TH1 will establish the connection automatically.

- 7) Adjust the receive (near-end) volume level using the RX LEVEL control. Then adjust the transmitted level using the Aux Output level control on the AC1.

- 8) When all volume levels are acceptable, disconnect the call by pressing the CONNECT button again.

- 9) Set the Setup/Operate dipswitch to the Operate position. If any limitation on the remote volume control range is desired, set the Volume Limit dipswitches accordingly.

- 10) The TH1 revisions 1.2 and higher now include firmware support for the J11 DC Bypass jumper. This jumper can be used to bypass the automatic disconnect circuitry on the TH1. This feature is intended to be used in installations where the TH1 is connected to an outside phone line through a PBX system which does not supply DC battery. By changing the position of the DC Bypass jumper, and by selecting the dipswitch option AUTO ANSWER to OFF, the TH1 will be transferred to fully manual operation. The factory default position is Auto Disconnect.

TROUBLESHOOTING

| SYMPTOM | POSSIBLE CAUSE |
|--|--|
| No receive sound from TH1 | 1) RX Level control not turned up 2) Connect LED not lit 3) Phone line from wall jack to TH1 not connected 4) The Send to Bus dipswitch is in the Off position (switch to On) |
| No transmit sound from TH1 to remote site | 1) TX Level control not turned up 2) Aux Output level control on AC1 not turned up 3) Aux Output not connected to IN(+) and IN(-). |
| Feedback or hollow sound | 1) Not enough Echo Suppression (increase Echo Suppression) 2) Large variations in phone line impedance (set Auto Initialize On) |

SPECIFICATIONS

| | |
|--------------------------------------|---|
| Power Requirements: | 200mA at $\pm 15V$ |
| Connectors: | Audio: Depluggable terminal blocks Telephone/Line: RJ-11 Modular Remote Control: DB-9 |
| Output Audio: | 100 Ohms, actively balanced |
| Input Audio: | Actively balanced, RF filtered |
| Input Impedance: | 10k Ω , balanced 5k Ω , unbalanced |
| Telephone Hybrid: | Standard hybrid transformer with DSP line return cancellation |
| Auto Answer: | Selectable - answers after first complete ring |
| Remote Volume Control: | Range: +6dB to -24dB and Off in 1dB steps. Range Limit: Selectable - No limit, +3dB/-6dB, +6dB/-6dB, +6dB/-12dB |
| Echo Suppression: | Selectable: Auto, 12dB, 18dB, 24dB |
| Call Frequency Response: | $\pm 1dB$ 200Hz to 3.5kHz |
| Caller THD (250Hz to 3.3KHz): | Less than 0.1% (0dBu out) |
| Send THD (250Hz to 3.3KHz): | Less than 0.1% (0dBu out) |
| Maximum Output Level: | +26dBu |

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 inter-connecting 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:

(505) 892-4501
(800) 821-1121
FAX: (505) 892-6243

World Wide Web: <http://www.lectrosonics.com>

email: sales@lectrosonics.com

LIMITED ONE YEAR WARRANTY

The equipment is warranted for one year from date of purchase against defects in materials or workmanship provided it was purchased from an authorized dealer. This warranty does not cover equipment which has been abused or damaged by careless handling or shipping. This warranty does not apply to used or demonstrator equipment.

Should any defect develop, 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.

LECTROSONICS, INC.

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