

# GT1524 Single Channel Echo Canceller



Installation & Operation Manual

**ClearOne**<sup>®</sup>  
You're Virtually There<sup>SM</sup>

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GT1524 Installation and  
Operation Manual  
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# GT1524 Installation and Operation Manual

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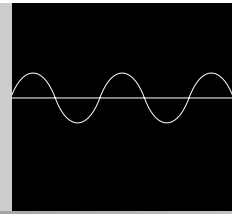
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# CHAPTER 1: Introduction



The GT1524 provides the highest possible audio quality available in a single channel echo canceller. It features an integrated telephone interface that enables telephone participants of an audio or video conference to sound as if they are actually in the same room. Plus, it features simultaneous two-wire/four-wire operation so you can audio conference and video conference at the same time. And there's no white noise setup; the GT1524 adapts automatically.

The GT1524 performs a variety of complex, integrated audio functions using digital signal processors (DSPs). Adjustments in level and other functions can be made via front panel programming, activation through a closure on the rear panel, or an RS-232 serial interface.

The integrated telephone interface provides the GT1524's audio conferencing capability and can be customized to suit your needs. It can be set to automatically answer upon detection of a valid ring and automatically disconnect on loop drop or call progress tones. The GT1524 includes a built-in five-watt power amp. The amp delivers 5W of output power into a 4 $\Omega$  speaker, eliminating the need to provide external amps for the speakers.

## Features

- Easy design, programming, installation, and maintenance.
- Each input incorporates automatic gain control to compensate for loud or soft talkers, while the mic/line input offers high-pass filtering to reduce unwanted low frequency noise.
- Integrated touch-tone dialing for easy dialing through remote control.
- ClearOne's digital signal processing technology ensures crystal-clear audio with the deepest, most reliable hybrid null.
- 8kHz sampling rate allows continual adaptation to telephone-line conditions.
- Acoustic echo cancellation (single channel) >120 ms DSP bases.
- Full-time telco echo cancellation with 31 millisecond tail time.
- Lockout front panel access for security.
- Phoenix push-on blocks make pin-for-pin wiring easier.



## Professional Services Group

If you need any additional information on how to install, set up, or operate your system, please contact us at one of the locations listed below. We welcome and encourage your comments so we can continue to improve our products and serve your needs.

ClearOne Communications ~ 1825 Research Way ~ Salt Lake City, UT 84119

### Technical Support

Telephone: 1.800.283.5936 (USA) or 1.801.974.3760  
Fax: 1.801.977.0087  
E-mail: [tech.support@clearone.com](mailto:tech.support@clearone.com)  
Web site: [www.clearone.com](http://www.clearone.com)

### Sales and Customer Service

Telephone: 1.800.945.7730 (USA) or 1.801.975.7200  
Fax: 1.800.933.5107 (USA) or 1.801.977.0087  
E-mail: [sales@clearone.com](mailto:sales@clearone.com)

### ClearOne Communications EuMEA GmbH

Leonhardstr. 16-18, D-90443 Nuremberg, Germany

Telephone: +49 911 955159-0  
Fax: +49 911 955159-10  
E-mail: [global@clearone.com](mailto:global@clearone.com)

### Product registration

Please register your GT1524 online at **[www.clearone.com](http://www.clearone.com)**. When your product is properly registered, ClearOne Communications is better able to serve you should you require technical assistance. Registration information is also used to notify you of upgrades and new product information.

### Product returns

All product returns require a return authorization (RA) number. Please contact ClearOne Technical Support before attempting to return your GT1524 unit.

## Unpacking

Ensure that the following items were received with your shipment:

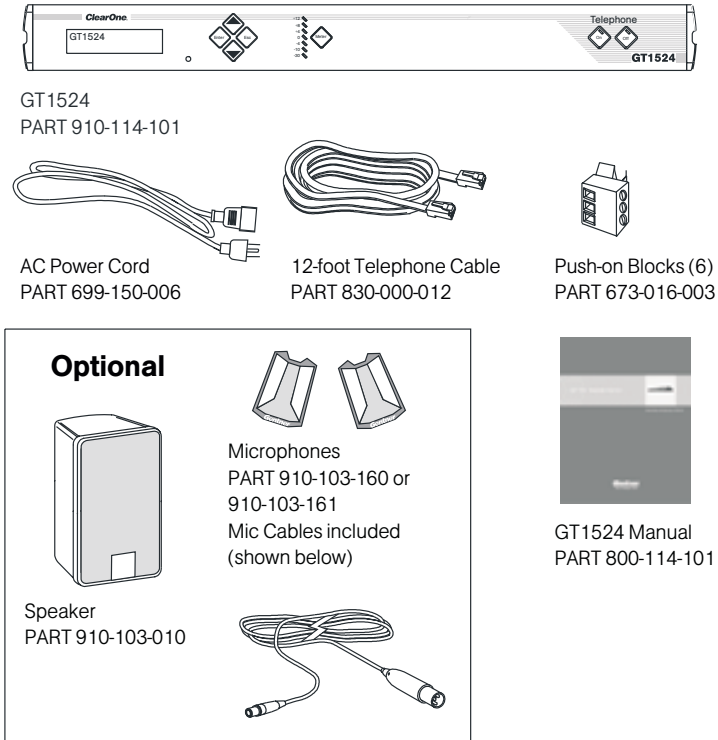



Figure 1.1. Unpacking Your GT1524

 ClearOne Communications is not responsible for product damage incurred during shipment. You must make claims directly with the carrier. Inspect your shipment carefully for obvious signs of damage. If the shipment appears damaged, retain the original boxes and packing material for inspection by the carrier. Contact your carrier immediately.

## Controls and Connections

### Front panel

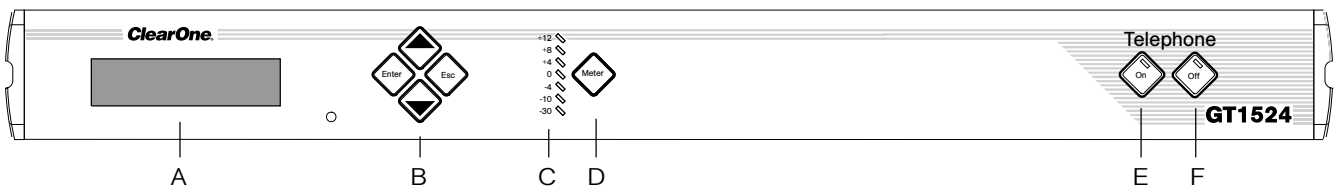


Figure 1.2. GT1524 Front Panel Controls

- A. **LCD window.** The two-line, 16-character-per-line LCD display is used for the GT1524 setup. Level adjustments are made through a menu system and four front-panel buttons [B]. Functions that can be accessed through the front-panel LCD include setup, programming, troubleshooting, and numeric audio level and gain readouts.
- B. **Enter/▲▼/Esc.** These buttons are used to navigate the LCD menu system.



- C. **LED Meter.** The LED bar meter displays the audio level of any input or output of the GT1524 as well as the Echo Return Loss (ERL) and Echo Return Loss Enhancement (ERLE) between the Speaker/Line Out and the Mic/Line audio input channel. The LED meter also displays Telco Echo Return Loss (TERL) and Telco Echo Return Loss Enhancement (TERLE) for the telephone hybrid.
- D. **Meter.** This button displays the Meter branch of the GT1524's LCD menu tree from which you can view or enter settings.
- E. **On.** The On button connects and adapts the GT1524 to the telephone line. Pressing and holding the On button for more than two seconds while the GT1524 is active sends a noise burst to readapt the unit to the phone line. A short tone (1000Hz) is sent out the Speaker and Line outputs to indicate that the GT1524 is connected to the line.
- F. **Off.** The Off switch disconnects the GT1524 from the telephone line and mutes all transmit audio to and from the telephone line. A short tone (400Hz) is sent out the Speaker and Line Outputs to notify the user that the GT1524 is disconnected from the line.

## Rear panel

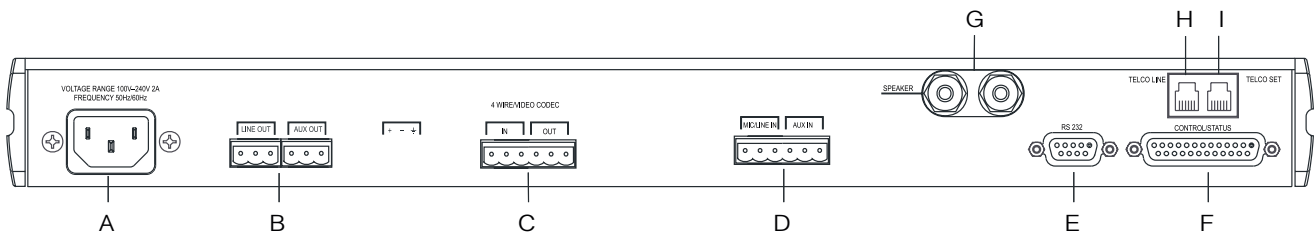


Figure 1.3. GT1524 Rear panel connectors

- A. **Power.** This power module accommodates power ranging from 100–240VAC, 50/60Hz, 30W. No switching is required.
- B. **Line Out, Aux Out.** These connection blocks are for line level outputs. The Line Output is used for connection to an external power amplifier or sound reinforcement system. The Aux Out is used for connection to recording equipment, such as a VCR. The nominal output level is 0dBu.
- C. **4 Wire/Video Codec In/Out.** Connects four-wire transmission systems, such as a video codec.
- D. **Mic/Line In, Aux In.** The Mic/Line input is for connection of a local microphone or input from a local sound system or mixer. The Aux In allows input from other audio sources, such as a VCR or CD player. Nominal input is 0dBu.



- E. **RS-232.** This female DB-9 serial port is for interconnection between the GT1524 and a PC or custom remote control. See Appendix C for serial port commands.
- F. **Control/Status.** This female DB-25 connector is used to interface parallel control and status to the GT1524. Control pins on this connector are used to perform functions via a momentary closure to ground. Each status pin on this connector shows the state of the function handled by the pin. Status pins are open collector outputs. When active, the output is pulled to ground; otherwise, the output is an open circuit. See Appendix B for control/status port pinout information.
- G. **Speaker.** One 5W, 4–16 $\Omega$  speaker can be directly connected to the GT1524, eliminating the need for a power amplifier.
- H. **Telco Line.** Connects to your telephone line source.
- I. **Telco Set.** Connects to your telephone handset.

## Operational Requirements

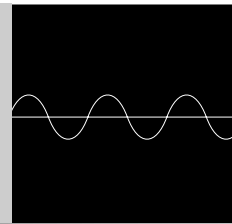
### Equipment placement

The GT1524 is designed for mounting in a 19-inch equipment rack. (Do not block any of the ventilation holes.) With a desktop kit, the GT1524 can be modified for tabletop placement.

### Telephone line requirements

The GT1524 operates on a standard analog telephone line and connects to the telephone system with a standard RJ-11C modular jack. If you do not have an RJ-11C jack where you want to install the GT1524, call your telephone company for installation.





## Hardware Setup

This chapter provides step-by-step instructions for installing your GT1524 system. Figure 2.1 (below) shows the back panel connections of a fully-installed GT1524 system.

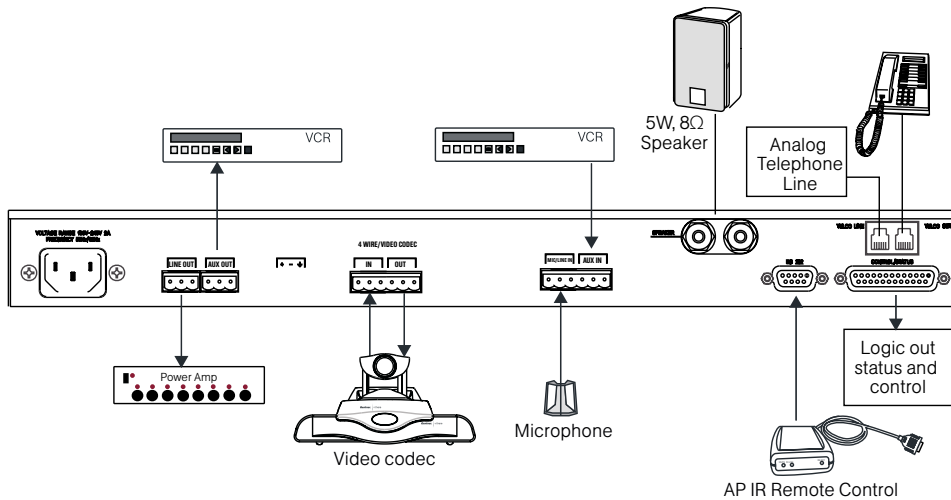


Figure 2.1. GT1524 installation

## Connecting the unit

The power cord should be connected last. Otherwise, the order in which you connect the cables is not important. Refer to the diagram shown in Figure 2.2 when making connections.

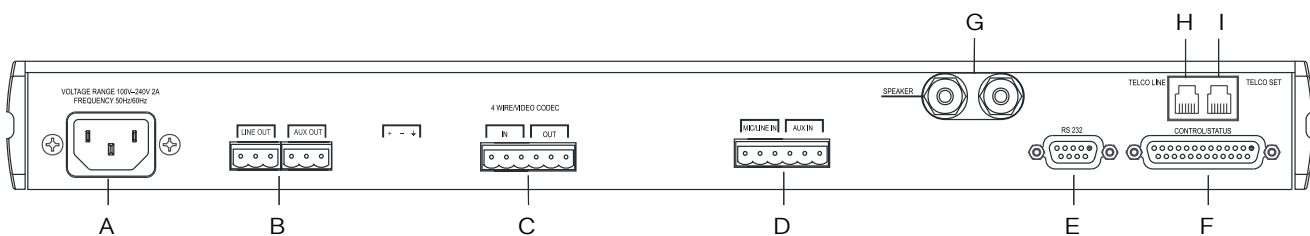



Figure 2.2. GT1524 Rear panel connectors

1. Place the unit in a standard 19-inch rack and attach it securely.
2. Connect your telephone line from the wall jack to the RJ-11 Line jack [H].
3. Plug your telephone set into the RJ-11 Set Jack [I].
4. If you are using a custom controller for control and status, plug it into the DB-25 Control/Status port [F].



 The three terminals in the Phoenix connector correspond with the rear-panel audio contacts (from left to right): + (positive), - (negative), and ↓ (ground).

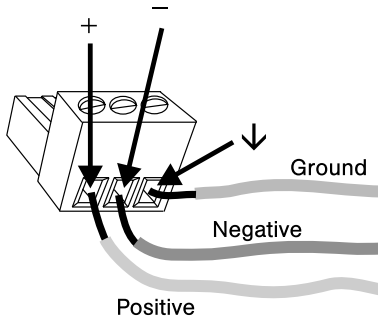


Figure 2.3. Phoenix push-on connector

5. Use the RS-232 port to connect the GT1524 to a PC (for use with HyperTerminal), an AP IR Remote Control, or a custom remote control device.
6. Connect an external amplifier or sound reinforcement system to Line Out. Use Aux Out to connect recording equipment, such as a VCR. Nominal output is 0dBu.
7. Using the included connectors, wire a 4-wire transmission system, such as a video codec, to the 4 Wire/Video Codec In and Out connectors. Nominal input/output is 0dBu.
8. Connect a local microphone or input from a local sound system or mixer to Mic/Line In.
9. Connect the speaker wire to the + (red) and - (black) binding post connectors.
10. Connect the power cable after making all other connections. As soon as power is supplied to the unit, the GT1524 initializes and all front-panel LEDs and the LCD light. The power module accommodates 100–240VAC, 50/60Hz, 22–30W.

## LCD Programming

For most installations, the default settings in the GT1524 do not need to be changed; the system can be used as soon as power is applied. However, if you need to customize any settings, such as telephone connection options or input parameters, you can do so through the front panel user interface.

The front panel includes a 2x16 character LCD, menu buttons, and LED bar meter. When power is applied to the GT1524, all LEDs light and the LCD panel reads INITIALIZING. If initialization is completed without errors, a title screen appears, showing the product name (top line) and the version number (bottom line). The title screen remains on display until you initiate some action that writes information to the LCD panel or the GT1524 detects and displays an error. If an error is displayed, contact ClearOne Technical Support.

## Menu trees

Four main menu trees (menu categories) comprise all of the GT1524 options you can control through the front panel: Inputs, Outputs, System, and Meters (see Figure 2.4). Enter each of the trees by pressing the up/down buttons and scrolling to the

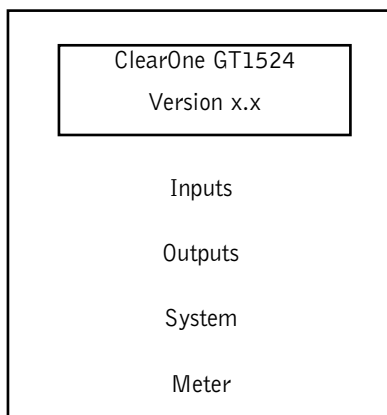


Figure 2.4. Main Menu Trees



appropriate menu. Then press Enter. To descend a menu level (go deeper into the tree), press Enter. To ascend a menu level (go back toward the top of the tree), press ESC.

The Meter button will also access the Meter tree directly. The menu trees are structured in levels, such that the first level (top of the tree) branches into multiple subcategories (see Figure 2.7). These branches typically end when an adjustable parameter or viewable value is reached.



Figure 2.5. Front Panel Buttons

## Adjusting a value

To adjust a parameter, first verify that it is flashing. If the parameter is not flashing, it cannot be adjusted until you press Enter. If the parameter is flashing, adjust the value with the Up and Down buttons. As the value is adjusted, the parameter is updated immediately. For example, if you adjust input gain, you should be able to hear the difference as it changes. To store the new value, press Enter. To discard the change and revert back to the old value, press ESC. In general, while adjusting parameters, numerical values do not wrap around when the end is reached. However, parameters that toggle between two values (or are a list of values) will wrap around. When adjusting a parameter, press and hold the Up or Down button for more than two seconds to scroll through the values at a faster rate.



Pressing ESC at the top of the tree has no effect.

GT1524 Parameters Worksheet				
<b>System-Wide Parameters</b>				
<b>Program Parameter</b>	<b>Selection Range</b>			
Lock Panel	On, Off			
Set Passcode	Any 5 Front Panel Keys (Enter)			
RS232 Baud Rate	9.6, 19.2, 38.4 kbps			
RS232 Flow Control	On, Off			
Telco Auto Answer	On, Off			
Telco Auto Disconnect	Off, Loop Drop, Call Prog, LD + CP			
Telco Ring Indication	Off, 1, 2, 3, 4			
Unit ID No.	Factory Programmed			
*Timeout	0 - 15 (10)			
*Telco Adapt Mode	Auto, Burst			
*Hook Duration	50 ms, 500 ms			
*Receive Reduction	On, Off			
<b>Meter</b>				
<b>Program Parameter</b>	<b>Selection Range</b>			
Default Meter	Any Input/Output (Spkr/Line Out)			
<b>Input Channel</b>		Mic/Line In	Aux In	4 Wire In
<b>Program Parameter</b>	<b>Selection Range</b>			
Gain Adjust	-20dB to 20dB (0)			
Mic/Line Input	Mic 55dB, Mic 25 dB, Line			
Mute	On, Off			
Phantom Power	On, Off			
AGC	On, Off			
High-Pass Filter	On, Off			
Echo Cancellation	On, Off			
NLP Adjust	Off, Soft, Medium, Aggressive			
<b>Output Channel</b>		Spkr/Line Out	Aux Out	4 Wire Out
<b>Program Parameter</b>	<b>Selection Range</b>			
Gain Adjust	-20dB to 20dB (0)			
Mute	On, Off			
Aux Out Mix (Mic/Line In)	On, Off			
Aux Out Mix (Aux In)	On, Off			

\* Set up only by serial port

Figure 2.6. Parameters Worksheet

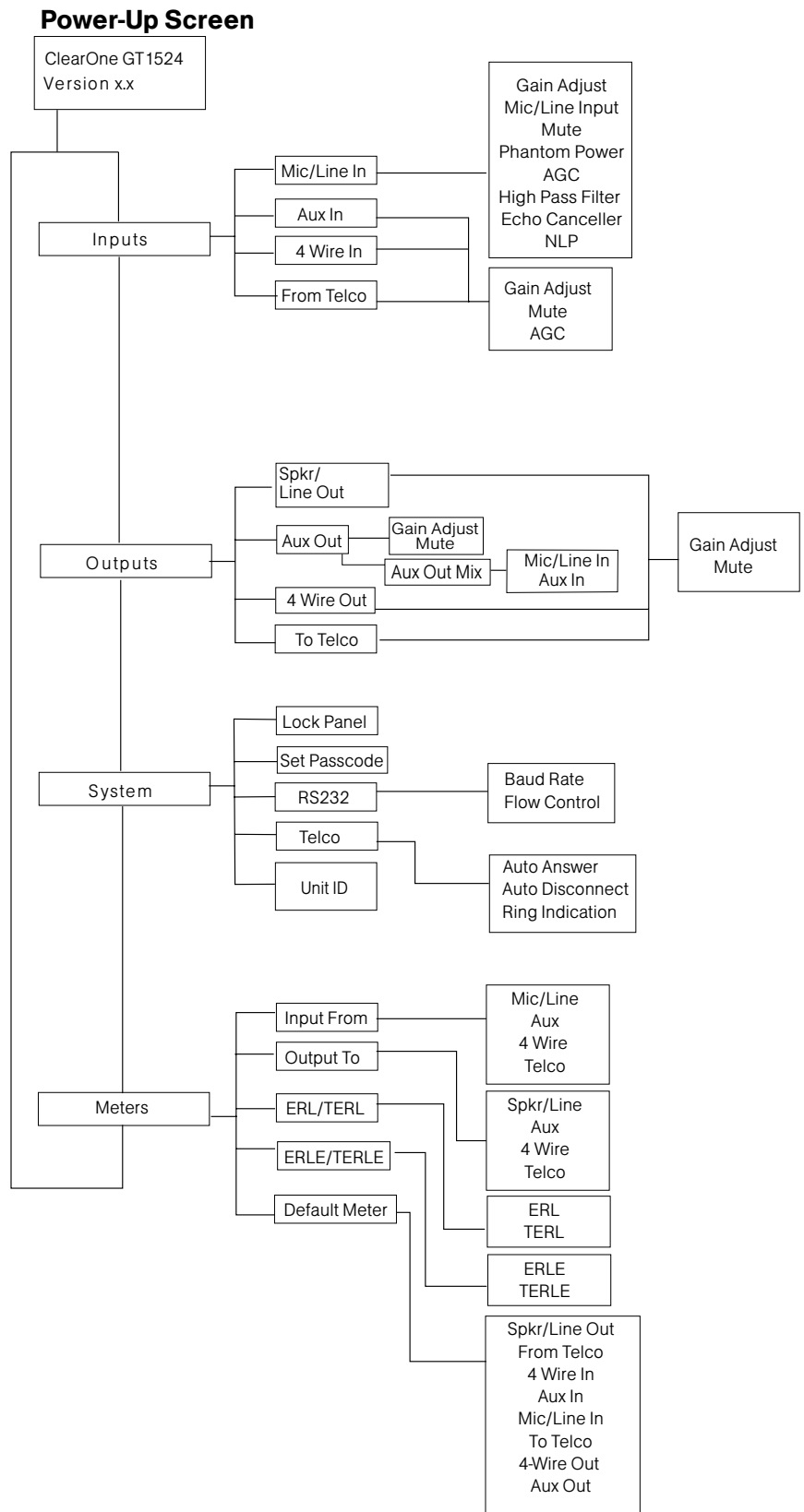


Figure 2.7. LCD Menu Tree and Defaults



# Inputs

There are four main submenus under the Inputs menu tree: Mic/Line In, Aux In, 4 Wire In, and From Telco (see Figure 2.7).

## Mic/Line In

**Gain Adjust.** This adjusts the Mic/Line In submenus, including the level for the Input gain (ranging between -20dB and 20dB). The default setting is 0dB.

**Mic/Line Input.** This input defaults as a line-level input (0dB gain) but can be switched to a mic level input (55dB or 25dB gain).

**Mute.** This parameter mutes the input channel.

**Phantom Power.** Defaults with 24V phantom power disabled, but may be switched on to accommodate input devices requiring phantom power.

**AGC.** The input can use automatic gain control (AGC). This feature keeps softer and louder talkers at a consistent transmit level. This feature is disabled when shipped from the factory. The target gain is 0dB and adjusts at 2dB per second. The AGC start adjustment is -20dB, but will adjust only +6dB. Adjustments will not be made at .5dB on either side of the target (0dB).

**High-Pass Filter.** A high-pass filter may be selected on the Mic/Line input to reduce unwanted noise. The filter has a break frequency at 250Hz, and -3dB down at 200Hz, then rolls off at 6dB per octave. This feature is disabled when shipped from the factory.

**Echo Canceller.** Activate or deactivate the echo cancellation feature for this input. Factory default is On.

**NLP Adjust.** Non-linear processing (NLP) has four settings: soft (6dB), medium (12dB), aggressive (18dB), and Off. NLP adds more echo cancelling "horsepower" in difficult acoustical environments. Use care when increasing NLP, because of the corresponding trade-offs which can include suppression and half-duplex operation. Factory default is Soft.

## Aux In, 4-Wire In, and From Telco

**Gain Adjust.** This adjusts each Input gain (ranging between -20dB and 20dB) in conjunction with the LCD readout and the LED bar graph. The default setting is 0dBu.

**Mute.** This parameter mutes the input channel.





**AGC.** The input can use automatic gain control (AGC). This feature keeps softer and louder talkers at a consistent transmit level. This feature is disabled when shipped from the factory. The target gain is 0dB and adjusts at 2dB per second. The AGC start adjustment is -20dB, but will adjust only +6dB. Adjustments will not be made at .5dB on either side of the target (0dB).

## Outputs

There are four main submenu under the Outputs menu tree: Speaker/Line Out, Aux Out, 4 Wire Out, and To Telco. Each of these submenus contain the same menus at the next menu depth: Gain Adjust and Mute. Aux Out also features an Aux Out Mix parameter, described below. Each parameter is applied to the respective outputs.

### Speaker/Line Out, 4 Wire Out, and To Telco

**Gain Adjust.** This adjusts each output's gain (ranging between -20dB and 20dB), in conjunction with the LCD readout and the LED bar meter. Default is 0dB.

**Mute.** This parameter mutes a particular output channel. Default is Off.

### Aux Out

**Gain Adjust.** This adjusts each output's gain (ranging between -20dB and 20dB), in conjunction with the LCD readout and the LED bar meter. Default is 0dB.

**Mute.** This parameter mutes a particular output channel. Default is OFF.

**Aux Out Mix.** This parameter selects Mic/Line In and/or Aux In to Aux Out.

## System

The System menu allows you to view five parameters: Lock Panel, Set Passcode, RS-232, Telco, and Unit ID. The first four may also be adjusted.

### Lock Panel

The GT1524 can be secured from unauthorized adjustments by locking the front panel and establishing a user passcode. Menu items can still be viewed when the panel is locked, but settings cannot be altered or entered until the panel is unlocked by entering the appropriate passcode.



If you enter a passcode and unlock the system, you must lock it again after making any changes. Otherwise the panel will remain unlocked and accessible to anyone.



### To lock the front panel

1. Enter the **System** menu
2. Scroll through the menu items to select **Lock Panel**, and press **Enter**.
3. Select **On**, and press **Enter** again.

### To unlock the front panel

1. Attempt to adjust a parameter. The GT1524 prompts you for the passcode.
2. Begin entering the passcode. Once you have correctly entered the fifth character, the front panel unlocks. (The default passcode for all units is Up, Up, Down, Down, Enter.)

## Set Passcode

Once you have unlocked the GT1524, you can change the passcode. Before the GT1524 allows passcode changes, the new passcode must be entered, then re-entered to validate it. The passcode must be five front panel buttons (in any combination or multiple).

## RS-232

Two RS-232 parameters can be adjusted through the front panel LCD: baud rate and flow control. If data is lost during serial access through the RS-232 port, a serial overrun error will occur. This is indicated on the LCD display. This parameter sets the GT1524's RS-232 port communication rate at 9,600 (default), 19,200, or 38,400 baud (bps).

**Baud.** To set the baud rate, scroll through the settings to select the desired baud rate, then press Enter.

**Flow Control.** The flow control parameter allows activation and deactivation of hardware flow control. The two options are On and Off (default). To activate the flow control, scroll to On and press Enter. To deactivate it, scroll to Off and press Enter.

## Telco

**Auto-Answer On/Off.** This parameter sets the telephone interface to automatically answer an incoming call (Auto-Answer On), or allow the call to be handled manually (Auto-Answer Off).

**Auto-Disconnect.** The interface can also be set to disconnect upon Loop Drop, Call Progress, Loop Drop + CP, or to disconnect manually (Auto-Disconnect Off).



**Ring Indication.** An audible ring indicator, sent to the PA output, can be enabled or disabled under this menu.

### Unit ID Number

The Unit ID # allows you to view the read-only unit address set at the factory. This unique ID number identifies that particular unit and cannot be changed.

## Meters

There are five main submenus under the meter menu tree: Inputs, Outputs, ERL/TERL, ERLE/TERLE, and Default Meter. The first four submenus are all handled in the same way.

### Inputs, Outputs, ERL/TERL, and ERLE/TERLE

Referencing the LCD, press the Meter button, then scroll through the options (Inputs, Outputs, ERL/TERL and ERLE/TERLE) to specify which is to be metered by the front-panel LED meter. When the appropriate option is visible, press Enter to begin monitoring its status on the front panel LCD. All items under this menu can be scrolled through by pressing the ▲/▼ arrows.

### Default Meter

The default meter parameter determines what is being displayed on the LED meter when the GT1524 times out.

## Timeout



Disabling the timeout will allow the GT1524 to remain in the same position in the LCD menu until the LCD menu is manipulated again.

The GT1524 has a system mode called Timeout. This parameter can be adjusted through the RS-232 port only using the TOUT command. Timeout controls the delay time (in minutes) before the LCD panel will automatically switch back to the title screen and default meter. The range is 0–15 minutes. Default is 10 minutes; 0 disables this mode.



A correctly installed GT1524 virtually runs by itself. Typical operations involve changing volume of an output, muting an input or output, or handling calls on the connected telephone handset. For most installations, a custom remote control (optional) is also used.

## Front Panel Control

### Controlling volume

When participating in a conference, you might find it necessary to increase or decrease the volume of a particular output. For instance, when the audio at a distant location is too soft, adjust the output to the speakers so that the level is comfortable.

#### To adjust the volume

1. Determine which output needs to be adjusted.
2. Scroll to the **Outputs** menu, select the appropriate output, and scroll to **Gain Adjust**. Press **Enter**.
3. Adjust the gain level using the ▲/▼ buttons. You should be able to hear the volume level adjust while increasing or decreasing the gain.
4. Press **Enter** when you reach the desired volume level.

The volume adjust procedure is the same for all channels.

### Muting

#### To mute and unmute

1. Select the input or output you want to mute and press **Enter**.
3. Scroll through the parameters until you see **Mute**. Press **Enter**.
4. Use the ▲/▼ buttons to select **On**, then press **Enter**. The input or output is now muted. To unmute, follow the same procedure, but select **Off** to deactivate the mute function.



For optimum performance, adjust all inputs to 0dBu before calibrating outputs.

## Answering a call

An incoming call rings on the telephone set connected to the GT1524 (and speaker, if one is connected to the GT1524) and causes the On LED to flash. There are four ways to answer an incoming call:

### To answer a call

You can answer a call using any of the following methods:

- Press the On button on either the front panel or on the remote control. This will route the call through the GT1524.
- Pick up the telephone handset and talk to your party over the telephone. Press the front panel On button to connect the call to the GT1524.
- Use external control such as an AMX or Crestron touch panel or custom control device. See page 21 for information on using serial commands.

## Making a call

Call the party using your handset. After the other party has answered, route the call through the GT1524 by pressing the On button.

The On LED lights and the GT1524 takes control of the call, disabling the telephone set. You can now safely hang up the handset without disconnecting the call or access the DTMF dialer in the GT1524 via a remote control system.

## Disconnecting a call

If the call is routed through the GT1524 (the On LED glows green), press the Off button on the front panel or send a command through the RS-232 port (TE 0). The Off LED glows red, and the On LED turns off.



If Auto-Answer is turned On under System settings, the GT1524 answers the call after the second complete ring. A ringing tone is provided to the Line and Speaker output if Ring Indication is turned on.



When using the DIAL serial port command, the GT1524 automatically engages the hybrid. You do not need to press the On button.



If Auto-Disconnect is turned On in System settings, the GT1524 disconnects upon sensing loop drop or call progress tones.



## Custom Control

### Custom controller options

The GT1524 is designed to function with remote control systems. The controller is connected to the GT1524 through the RS-232 port. The AP IR Remote also functions with the GT1524.

You can perform all actions through the custom controller:

- Turn the GT1524 telephone connection on or off
- Mute transmitted and received audio
- Generate DTMF tones
- Adjust volume on received audio
- Re-null the telephone hybrid
- Meter input and output
- Read TERL and TERLE
- Control any function on the unit



ClearOne Communications recommends use of a custom remote controller for user interface. Refer to the manufacturer's documentation for your particular custom remote controller.





## Appendix A: Specifications

### Dimensions (LxDxH)

17.25" x 10.25" x 1.75"  
43.8 x 26 x 4.5 cm

### Weight

7 lb/3.18 kg dry  
12 lb/5.4 kg shipping

### Operating Temperature

32 to 100° F/0 to 38° C

### Humidity

15% to 80%, non-condensing

### Power Input Range

Auto-adjusting  
100–240VAC; 50/60Hz

### Power Consumption

30W typical

### RS-232

DB-9 female  
9,600 (default)/19,200/38,400 baud  
rate  
8 bits, 1 stop, no parity  
Hardware flow control on (default)/off

### Control/Status

DB-25 female  
Inputs: active low (pull to ground)  
Outputs: open collector, 40VDC max,  
40mA each  
+5V pins (2), 300mA each

### Mic/Line Input

Push-on terminal block, balanced,  
bridging  
Impedance: 5k $\Omega$   
Nominal Level: adjustable -55dBu,  
0dBu  
Maximum Level: -33dBu, +20dBu

Echo Cancellation: 120ms tail time  
(works with 12dB of room gain)  
Phantom Power: 24V, selectable

### AUX In

Push-on terminal block, balanced,  
bridging  
Impedance: 20k $\Omega$   
Nominal Level: 0dBu  
Maximum Level: 19dBu

### 4 Wire/Video Codec In

Push-on terminal block, balanced,  
bridging  
Impedance: 20k $\Omega$   
Nominal Level: 0dBu  
Maximum Level: 19dBu

### Line Output

Push-on terminal block, balanced,  
bridging  
Impedance: 50 $\Omega$   
Nominal Level: 0dBu  
Maximum Level: 19dBu

### AUX Output

Push-on terminal block, balanced,  
bridging  
Impedance: 50 $\Omega$   
Nominal Level: 0dBu  
Maximum Level: 19dBu

### 4 Wire/Video Codec Out

Push-on terminal block, balanced,  
bridging  
Impedance: 50 $\Omega$   
Nominal Level: 0dBm  
Maximum Level: 19dBu

### Speaker Output

Binding post; 5W max into 4 $\Omega$

### Telco Line

RJ-11 connector  
POTS (plain old telephone service)  
line or analog extension from PBX

### Telco Set

RJ-11 connector  
Connect analog telephone set  
A-lead supervision provided

### Audio Performance Conditions

Unless otherwise specified, all measure-  
ments are performed with a 22Hz to  
22kHz BW limit (no weighting).  
Frequency Response: 20Hz to 15kHz  
 $\pm$ 2dB  
Noise (EIN): -125dBu, 15kHz BW,  
max gain,  $R_s=150\Omega$   
THD+N: <0.1%  
SNR: 65dB re 0dBu  
Dynamic Range: 85dB

### Telco Audio Performance

Frequency Response: 250Hz to 3.3kHz  
 $\pm$ 2dB (AGC disabled)  
SNR: >60dB re -15dBm on/off the  
telephone line  
THD+N: <0.2%, 250Hz to 3.3kHz  
(AGC disabled)  
Pre-emphasis: +4dB @ 2kHz  
TEC tail time: 31ms  
TEC null: 55dB nominal

### Approvals

FCC, ASA, CE



## Appendix B: Pinouts

### Control/Status port pinout (female)

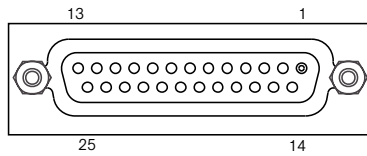


Figure B.1. DB-25 connector



All commands are momentary.



The first 16 pins of the Control/Status port are programmable through direct serial port commands.

Pin	Definable	Type	Default Description
1	Yes	Control	Aux In to Aux Out toggle
2	Yes	Status	Status of Aux In to Aux Out
3	Yes	Control	Mute Mic/Line In toggle
4	Yes	Status	Status of Mic/Line In mute
5	Yes	C	Telephone On/Off toggle
6	Yes	S	Status of tel. On/Off toggle
7	Yes	C	Auto Answer toggle
8	Yes	S	Status of Auto Answer
9	Yes	C	Mute Line Out toggle
10	Yes	S	Status of Line Out mute
11	Yes	C	Mute 4-Wire In toggle
12	Yes	S	Status of 4-Wire In mute
13	Yes	C	Volume up Speaker/Line (1dB)
14	Yes	S	No connection
15	Yes	C	Volume down Spkr/Line (1dB)
16	Yes	S	No connection
17	No	S	No connection
18	No	S	No connection
19	No	S	No connection
20	No	S	No connection
21	No	S	Ring indication
22	No	S	No connection
23	No	S	+5VDC
24	No	S	+5VDC
25	No	Ground	Ground

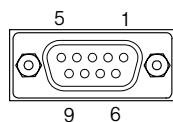


Figure B.2. RS-232 connector

### RS-232 COM DCE port pinout (female)

Pin Number	Control	Pin Number	Control
1	DCD	6	DSR
2	TXD	7	CTS
3	RXD	8	RTS
4	DTR	9	No connection
5	Ground		



## Appendix C: Serial Commands

The GT1524 accepts serial commands through the serial port. The commands in this manual pertain only to the GT1524. RS-232 serial port protocol is 9,600 (default), 19,200, or 38,400 baud; 8 bits, 1 stop bit, no parity.

### Conventions

The following typographic conventions are used in this document to describe the different serial commands. Use the Command structure section and the examples as a guide when creating your serial commands.

Convention	Description
<X>	Parameters enclosed in < > indicate a mandatory parameter.
[X]	Parameters enclosed in [ ] indicate an optional parameter.
1-8	Parameters separated by a - indicate a range between the values.
4,7,9	Parameters separated by a , indicate a list of available values.
<b>MREF</b>	Words in uppercase bold indicate command text.

### Command structure

Commands can be either UPPERCASE or lowercase. Also, extra spaces or tabs between arguments in text commands are allowed. Return values are always in uppercase. In order for a command to be recognized by the serial port, the command must be terminated by a carriage return.

The structure of serial commands is as follows: **COMMAND** [X] [X]

<b>COMMAND</b>	is the command text
[X] [X]	represents any additional options in the order that they appear in the command descriptions that follow

### Error codes

Error 1 (Future)

Error 2 Could not extract a command from the string received

Error 3 Serial overrun

Error 4 Reserved

Error 5 Invalid parameter

Error 6 Unrecognized command



<b>GT1524 Serial Commands</b>	
<b>Command</b>	<b>Function</b>
AA	Selects/Reports Auto Answer for Telco Port
AD	Selects/Reports Auto Disconnect for Telco Port
AGC	Enables/Disables AGC†
AUXMIX	Enables/Disables Mic/Line In and Aux In to Aux Out
BAUD	Sets/Reports RS-232 Port Baud Rate
DFLTM	Sets/Reports Default Meter
DIAL	Sends Dial String to Telco Port
EC	Enables/Disables Echo Cancellor
ERL	Returns ERL for the Mic/Line In Channel
ERLE	Returns ERLE for the Mic/Line In Channel
FLOW	Enables/Disables Flow Control
FPP	Sets/Reports Front Panel Passcode
GAIN	Sets/Reports Gain Setting†
HOOK	Sends Hook/Flash Command
HOOKD	Selects/Reports Hook Duration Time
LFP	Enables/Disables Front Panel Lock
LVL	Reports Level†
MHP	Sets/Reports High Pass Filter Status
MLINE	Sets/Reports Mic Gain
MUTE	Sets/Reports Mute†
NLP	Sets/Reports Non-Linear Mic Processing
NULL	Sends Noise Burst, Adapting Unit to Phone Line
PP	Sets/Reports Phantom Power for Mic/Line In
RING	Reports Presence of a Ring on Telco Port
RINGEN	Selects/Reports Ring Indication
RXRD	Sets/Reports Receive Reduction to Telco Port
TAMODE	Sets/Reports Telco Adapt Mode
TE	Sets/Reports Telco Off Hook Status
TERL	Returns Echo Return Loss for Telco Channel
TERLE	Returns Echo Return Loss Enhancement for Telco Channel
TOUT	Sets/Reports Inactivity Timeout
UID	Returns ID Number of Unit
VER	Returns Current Version of Software

†Applied to a specific channel



## AA

This command activates and deactivates the auto answer feature.

Command form: **AA** <X>

### Explanation

Value            0 = Disables auto-answer  
                   1 = Enables auto-answer  
                   2 = Toggles between states (regardless of current state)  
                   Null = Reports back the current state

### Return values

The command will return the updated condition (On=1, Off=0) of the auto answer in the same format as the command.

## AD

This command changes the state of the auto disconnect function.

Command form: **AD** <X>

### Explanation

Value            0 = Sets Auto Disconnect to Off  
                   1 = Sets Auto Disconnect to Loop  
                   2 = Sets Auto Disconnect to Call Progress (CP)  
                   3 = Sets Auto Disconnect to Loop+CP  
                   Null = Reports back the current state

### Return values

The command will return the updated connection state of the unit in the same format as the command. If the sent command changes the state of the unit, the updated state is returned.

<b>If:</b>	<b>Command Returns:</b>
current disconnect state is Off	AD 0
current disconnect state is Loop	AD 1
current disconnect state is CP	AD 2
current disconnect state is Loop+CP	AD 3

## AGC

This command changes or reports back the state of the AGC for a microphone or line input. Command form: **AGC** <CH> <X>

### Explanation

Channel            1 = Mic/Line Input, 2 = Aux Input, 3 = 4 Wire Input  
                   4 = Telco Input

Value            0 = Sets the state to Off  
                   1 = Sets the state to On  
                   2 = Toggles between states (regardless of current state)  
                   Null = Returns the current state

### Return values

The command will return the updated condition (On=1, Off=0) of the AGC in the same format as the command.

## AUXMIX

This command changes or reports back the state of the Aux Mix Out.

Command form: **AUXMIX** <CH> <X>

### Explanation

Channel            1 = Mic/Line In, 2= Aux In

Value             0 = Sets state to Off, 1 = Sets the state to On

### Return values

The command will return the updated condition of the Aux Mix in the same format as the command.

## BAUD

This command selects or returns the baud rate for the RS-232 port on the GT1524.

Command form: **BAUD** <X>

### Explanation

Value             1 = Selects 9,600 baud (bps) rate  
                    2 = Selects 19,200 baud (bps) rate  
                    3 = Selects 38,400 baud (bps) rate  
                    Null = Returns the baud (bps) rate

### Return values

The command will return the updated condition (1 = 9,600 baud, 2 = 19,200 baud, 3 = 38,400 baud) of the RS-232 baud rate in the same format as the command.

## DFLTM

This command changes and reports back the status of the default meter.

Command form: **DFLTM** <CH> <X>

### Explanation

Channel            1 = Mic/Line Input, Line Output  
                    2 = Aux Input, Aux Output  
                    3 = 4 Wire Input, 4 Wire Output  
                    4 = Telco Input, Telco Output

Value             I = Specifies an input channel  
                    0 = Specifies an output channel

### Return values

The command will return the current default meter in the same format as the command.



## DIAL

This command generates DTMF tones. This capability remains active after the call is placed so tones can be issued for use with voice mail and pagers.

Command form: **DIAL** <STRING>

### Explanation

STRING is any valid combination of touch tone characters. A comma indicates a two-second pause. STRING has a maximum length of 15 characters. Valid characters are 0 through 9, A through D, \*, # and \, ".

### Return values

DIAL returns the dialed string of numbers. For example, the following command dials the number 801-975-7200: DIAL 9,8019757200 A \"9\" and a pause are generated to get an outside line on a PBX. The following is returned out the serial port: DIAL 9,8019757200

## EC

This command changes or reports back the state of the echo canceller.

Command form: **EC** <X>

### Explanation

Value            0= Sets the state to Off  
                  1 = Sets the state to On  
                  Null = Returns the current state

### Return values

The command will return the updated condition (On=1, Off=0) of the echo canceller in the same format as the command.

## ERL

This command reports back the echo return loss (ERL) in dB.

Command form: **ERL**

### Return Values

The command will return the ERL in the same format as the command (ERL 20).

## ERLE

This command reports back the echo return loss enhancement (ERLE) in dB.

Command form: **ERLE**

### Return values

The command will return ERLE in the same format as the command (ERLE 20).

## FLOW

This command selects or reports whether hardware flow control is enable or disabled for the GT1524. Hardware flow control is implemented using RTS and CTS.

Command form: **FLOW** <X>

### Explanation

Value            0 = Sets flow control to Off  
                   1 = Sets flow control to On  
                   Null = Returns the current mode

### Return values

The command will return the updated condition (On=1, Off=0) of the GT1524 in the same format as the command.

## FPP

This command sets and reports the current passcode setting for the GT1524.

Command form: **FPP** <X>

### Explanation

Value            1 = Up button  
                   2 = Enter button  
                   3 = ESC button  
                   4 = Down button  
                   5 = Meter button  
                   Null = Return current passcode

### Return values

The command returns the current or updated condition of the front panel passcode.

## GAIN

This command changes or reports back the gain for a channel. The command supports all inputs and outputs. Command form: **GAIN**<CH><X1><X2>[X3]

### Explanation

Channel            1 = Mic/Line Input, Line Output  
                   2 = Aux Input, Aux Output  
                   3 = 4 Wire Input, 4 Wire Output  
                   4 = Telco Input, Telco Output

Value 1            I = Selects Input, 0 = Selects Output

Value 2            -20 to 20 to set the level  
                   Null to return the current level

Value 3            R = Indicates relative  
                   A = Indicates absolute  
                   Null will default to R (relative)

### Return values

The command will return the updated level of the channel in the same format as the command. The level returned is always absolute.



### Example

The following command lowers the gain 3dB on the Mic/Line input channel.

**GAIN** 1 1 -3

### HOOK

This command sends a momentary interruption in the line seizure (hook flash) to the telephone line. Command form: **HOOK**

#### Return values

If hook flash succeeded, the following is returned out the port: HOOK 0

### HOOKD

This command controls and reports the Hook Duration of the unit.

Command form: **HOOKD** <X>

#### Explanation

Values            1 = Sets Hook Duration to 50 ms  
                  2 = Sets Hook Duration to 500 ms  
                  Null = Reports back the current state

#### Return values

The command will return the current hook duration of the unit in the same format as the command. If the sent command changes the hook duration of the unit, the updated hook duration is returned.

### LFP

This command locks, unlocks, or returns the current state of the front panel from the serial port. Command form: **LFP** <X>

#### Explanation

Values            0 = Unlocks the front panel  
                  1 = Locks the front panel  
                  2 = Toggles between states (regardless of current state)  
                  Null = Returns the current state of the front panel

#### Return values

The command will return the updated condition of the front panel.



## LVL

This command reports back the level for a given channel.

Command form: **LVL** <CH> <X>

### Explanation

Channel	1 = Mic/Line Input, Line Output 2 = Aux Input, Aux Output 3 = 4 Wire Input, 4 Wire Output 4 = Telco Input, Telco Output
Value	I = Specifies an input meter 0 = Specifies an output meter

### Return values

The command will return the input level of the channel in the same format as the command.

## MHP

This command changes or reports back the state of the high pass filter for the Mic/Line input. Command form: **MHP** <X>

### Explanation

Value	0 = Sets the state to Off 1 = Set the state to On Null = Returns the current state
-------	--

### Return values

The command will return the updated condition (On=1, Off=0) of the high pass filter in the same format as the command.

## MLINE

This command changes or reports back how much gain is applied to the Mic/Line input. The three settings are 0dB, 25dB, and 55dB.

Command form: **MLINE** <X>

### Explanation

Value	1 = Sets the state to 55dB gain 2 = Sets the state to 25dB gain 3 = Sets the state to 0dB (line level) Null = Returns the current state
-------	--

### Return values

The command will return the updated condition of the gain applied in the same format as the command.



## MUTE

This command changes or reports the state of mute for a given channel.

Command form: MUTE <CH> <X1> <X2>

### Explanation

Channel	1 = Mic/Line Input, Line Output 2 = Aux Input, Aux Output 3 = 4 Wire Input, 4 Wire Output 4 = Telco Input, Telco Output
Value 1	I = Specifies input 0 = Specifies output
Value 2	0 = Sets mute to Off 1 = Sets mute to On (mute the selected channel) 2 = Toggles between states (regardless of current state) Null = Reports current mute state for the selected channel

### Return values

The command will return the mute status (On=1, Off=0) in the same format as the command.

## NLP

This command changes or reports back the state of the nonlinear processing for the echo canceller. Command form: **NLP** <X>

### Explanation

Value	0 = Sets the state to Off 1 = Sets the state to soft 2 = Sets the state to medium 3 = Sets the state to aggressive Null = Returns the current state
-------	---

### Return values

The command will return the updated condition (0=Off, 1=Soft, 2=Medium, 3=Aggressive) of the nonlinear processing in the same format as the command.

## NULL

This command sends a short noise burst down the telephone line and adapts the GT1524 to the telephone line. Command form: **NULL**

### Return values

NULL is returned out the serial port when the command has been executed.

## PP

This command changes or reports back the state of the phantom power for a microphone. Command form: **PP** <X>

### Explanation

Value            0 = Sets the state to Off  
                  1 = Sets the state to On  
                  Null = Returns the current state

### Return values

The command will return the updated condition (On=1, Off=0) of the phantom power in the same format as the command.

## RING

This command reports the presence of a Ring on the Telco port. (This is an indication only.) Command form: **RING**

### Return value

The Ring is sent if a valid ring has been sensed on the Telco line: RING

## RINGEN

This command changes or reports back the state of the Ring Indication.

Command form: **RINGEN** <X>

### Explanation

Value            0 = Sets the state to Off  
                  1 = Sets the state to Ring 1  
                  2 = Sets the state to Ring 2  
                  3 = Sets the state to Ring 3  
                  4 = Sets the state to Ring 4  
                  Null = Returns the current state

### Return values

The command will return the updated condition of the Ring Indication in the same format as the command.

## RXRD

This command controls or reports the Receive Reduction control of the unit.

Command form: **RXRD** <X>

### Explanation

Values           0 = Sets Receive Reduction to Off  
                  1 = Sets Receive Reduction to On  
                  2 = Toggles the current state  
                  Null = Reports back the current state

### Return values

The command returns the updated connection state of the unit in the same format as the command.

## TAMODE

This command controls or reports the Telephone Adapt Mode control of the unit.

Command form: TAMODE <X>

### Explanation

Value            0 = Sets Telephone Adapt Mode to Auto  
                  1 = Sets Telephone Adapt Mode to Burst  
                  Null = Reports back the current state

### Return value

The command returns the updated connection state of the unit in the same format as the command.

## TE

This command controls or reports the connection status of the unit.

Command form: **TE** <X>

### Explanation

Values            0 = Sets the unit to disconnect from the line  
                  1 = Sets the unit to connect to the line  
                  2 = Toggles the states  
                  Null = Reports back the current state

### Return value

If the current state is On, the following is returned: TE 1. If the current state is Off, the following is returned out the serial port: TE 0

## TERL

This command reports back the telephone echo return loss (TERL) for the GT1524 in decibels. Command form: **TERL**

### Example

If the current TERL level is 10dB, the following is returned out the serial port:  
TERL 10

## TERLE

This command reports back the telephone echo return loss enhancement (TERLE) for the GT1524 in decibels. Command form: **TERLE**

### Example

If the current TERLE level for the telephone canceller is 20dB, the following is returned out the serial port: TERLE 20

## TOUT

This command sets or reports the current inactivity timeout before returning to the menu screen used by the unit. Command form: TOUT <X>

### Explanation

Value                    0 = Disables inactivity timeout  
                          1–15 = Sets the number of minutes specified  
                          Null = Returns the current number of minutes

### Return Values

The command will return the current timeout value. If the command changed the timeout, the updated timeout is returned.

## UID

This command returns the unique ID number, the device type, and the device number of the GT1524. This command is read only. The unique ID number is preprogrammed at the factory and is unique to the unit. Command form: **UID**

### Return Values

UID returns the device type and unique ID number. The unique ID is composed of an eight-digit hex number assigned at the factory to uniquely identify the unit.

### Example

The following command requests the unit ID from device: UID

The following is returned out the serial port: UID A4EF906C

## VER

This command returns the current version of software. This version is unique to a released version of software and is comprised of the DSP, the FPGA, and HC11 software. This command is read only. **VER**

### Return Values

VER returns the version of software in the same format as the command. The Version is composed of a major version number followed by a period and a minor version number.

### Example

The following command requests the software version: The following is returned out the serial port: VER 2.0

## Warranty

ClearOne Communications, Inc. (Manufacturer) warrants that this product is free of defects in both materials and workmanship. Should any part of this product be defective, the Manufacturer agrees, at its option, to:

- A. Repair or replace any defective part free of charge (except transportation charges) for a period of one year from the date of installation for the end-user, provided the owner returns the product to the Manufacturer at the address set forth below. No charge will be made for parts or labor during this period;
- B. Furnish replacement for any defective parts in the product for a period of one year from the date of original purchase. Replacement parts shall be furnished without charge, except labor and transportation.

This Warranty excludes assembled products not manufactured by the Manufacturer whether or not they are incorporated in a Manufacturer product or sold under a Manufacturer part or model number.

### THIS WARRANTY IS VOID IF:

- A. The product has been damaged by negligence, accident, act of God, or mishandling, or has not been operated in accordance with the procedures described in the operating and technical instructions; or,
- B. The product has been altered or repaired by other than the Manufacturer or an authorized service representative of the Manufacturer; or,
- C. Adaptations or accessories other than those manufactured or provided by the Manufacturer have been made or attached to the product which, in the determination of the Manufacturer, shall have affected the performance, safety or reliability of the product; or,
- D. The product's original serial number has been modified or removed.

NO OTHER WARRANTY, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR ANY PARTICULAR USE, APPLIES TO THE PRODUCT. MANUFACTURER'S MAXIMUM LIABILITY HEREUNDER SHALL BE THE AMOUNT PAID BY THE END-USER FOR THE PRODUCT. No person or entity authorized to assume any obligation or other liability in connection with the products. No action, regardless of form, arising out of or relating to the product or this Warranty, may be brought by end-user more than one (1) year after the cause of action has accrued.

Manufacturer shall not be liable for punitive, consequential, or incidental damages, expenses, or loss of revenue or property, inconvenience, or interruption in operation experienced by the end user due to a malfunction in the purchased product. No warranty service performed on any product shall extend the applicable warranty period.

In case of unsatisfactory operation, the end-user shall promptly notify the Manufacturer at the address set forth below in writing, giving full particulars as to the defects or unsatisfactory operation. Upon receipt of such notice, the Manufacturer will give instructions respecting the shipment of the product, or such other matters as it elects to honor this warranty as above provided. This warranty does not cover damage to the product during shipping and the Manufacturer assumes no responsibility for such damage. All shipping costs shall be paid by the customer.

This warranty extends only to the original end user and is not assignable or transferable. This Warranty is governed by the laws of the State of Utah, without regard to the conflicts of interests provisions thereof.

ClearOne Communications  
1825 Research Way  
Salt Lake City, Utah 84119

## Appendix E: Compliance

### FCC Part 15 compliance

This device complies with part 15 of the FCC rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

### FCC Part 68 compliance

A label containing, among other information, the FCC registration number and Ringer Equivalence Number (REN) for this equipment is prominently posted on the equipment. If requested, this information must be provided to your telephone company.



**USOC Jacks:** This device uses RJ11C and RJ21X terminal jacks.

The REN is used to determine the quantity of devices which may be connected to the telephone line. Excessive RENs 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 RENs should not exceed five (5). To be certain of the number of devices that may be connected to the line, as determined by the total RENs, contact the telephone company to obtain the maximum RENs 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 is not practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right 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 for you to make the necessary modifications in order to maintain uninterrupted service.

If you experience problems with this equipment, contact ClearOne Communications, Inc., 1825 Research Way, Salt Lake City, Utah 84119, or by phone at (801) 874-3760 for repair and 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.

## Industry Canada compliance

The Industry of Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective operational and safety requirements. The Department does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The equipment must also be installed using an acceptable method of connection. In some cases, the company's inside wiring associated with a single line individual service may be extended by means of a certified connector assembly (telephone extension cord). The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by ClearOne Communications. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may



give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

## European compliance (for international unit part no. 910-114-102 only)

This equipment has been approved in accordance with Council Decision 98/482/EC for pan-European single terminal connection to the public switched telephone network (PSTN). However, due to differences between the individual PSTNs provided in different countries, the approval does not, of itself, give an unconditional assurance of successful operation on every PSTN network termination point.

In the event of problems, you should contact your equipment supplier in the first instance.

ClearOne Communications, Inc. of 1825 Research Way, Salt Lake City, Utah 84119, U.S.A. declares that this equipment is designed to be compatible with the following networks: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Liechtenstein, Luxembourg, The Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and United Kingdom



The international unit, part no. 910-114-102, complies with the requirements of the European guidelines:

89/336/EEC	"Electromagnetic Compatibility"
73/23/EEC	"Electrical operating material for use within specific voltage limits"
98/482/EC	"Single terminal connection to the public switched telephone network."

Conformity of the equipment with the above guidelines is attested by the CE mark.

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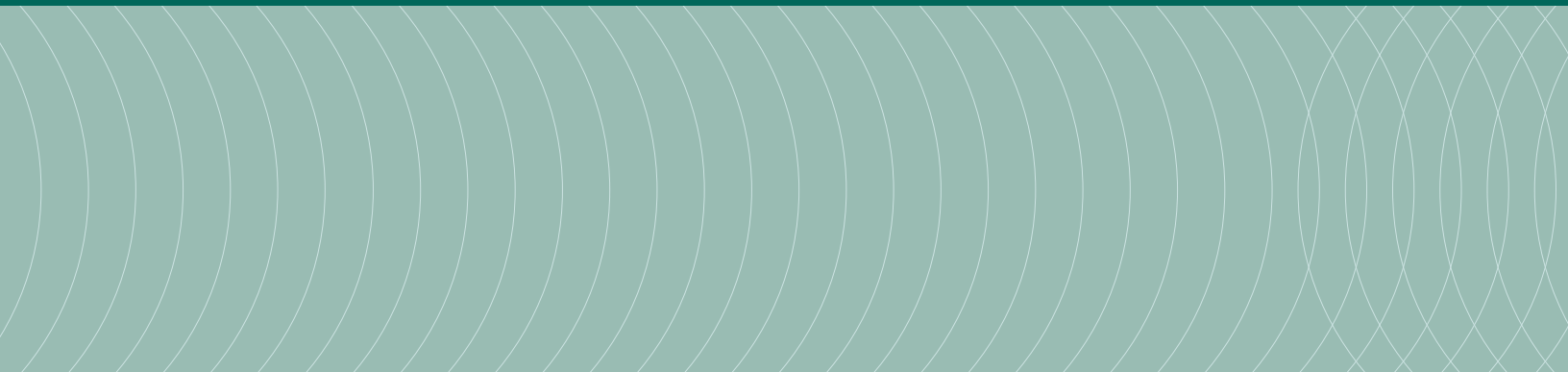
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