ADTRAN

Troubleshooting Guide

Analog Configuration and Trunk Troubleshooting

This troubleshooting guide describes the echo return loss (ERL) measurement tool available in ADTRAN Operating System (AOS) voice products. Included in this guide are the procedures for running the automated testing tool, interpreting the test results, adjusting configuration settings on the analog line for better sound quality and troubleshooting suggestions for possible issues experienced on analog lines.

The following topics are covered in this guide:

Overview of ERL Measurement Tool

For every installation using analog lines, the proper line impedance should be configured. Often when installing phone systems with analog trunks, adjustments are necessary to match the foreign exchange office (FXO) interface to the characteristics of the analog line. AOS voice products and NetVanta FXO Voice Interface Modules (VIMs) provide various adjustments for matching the characteristics of analog lines.

The AOS ERL tool is provided to automatically determine the correct impedance value for analog lines connected to the FXO ports. It is helpful when troubleshooting problems and assists in correctly adjusting the audio levels. The ERL tool tests each line with multiple impedance values to determine which is the best match based on the ERL value calculated. Once the proper impedance value is configured, further adjustments can be made using the FXO transmit gain, FXO receive gain, Realtime Transport Protocol (RTP) transmit gain, and RTP receive gain. This feature is only available on units as outlined in the *Hardware and Software Requirements and Limitations on page 3*.

During the test, the tool sets the FXO transmit gain and receive gain levels to 0 dB to make the proper measurements. These settings are returned to the configured values when the test is complete. The receive gain value adjusts the level being transmitted from the FXO port on to the line. The transmit gain value adjusts the level being transmitted from the FXO port to the digital signal processor (DSP). Refer to *Understanding and Adjusting FXO Gains* below for more information on FXO gains.

Prerequisites

Prior to using the ERL tool, an analog line from the service provider must be connected to the FXO interface, and the line must be idle (no call in progress). The FXO interface must be connected to a voice trunk in order to make the tool available for use. For more information regarding configuring analog trunks, refer to *Configuring NetVanta 7000 Series Trunk Accounts* available online at https://supportforums.adtran.com.

Understanding and Adjusting FXO Gains

FXO transmit and receive gains are set to 0 dB by default. The default values are not modified during ERL testing but are temporarily set to 0 dB for the duration of the testing and returned to the previous values when testing is complete. Before modifying them, it is important to understand which direction each value affects. The diagram below outlines specifically where each gain is applied.
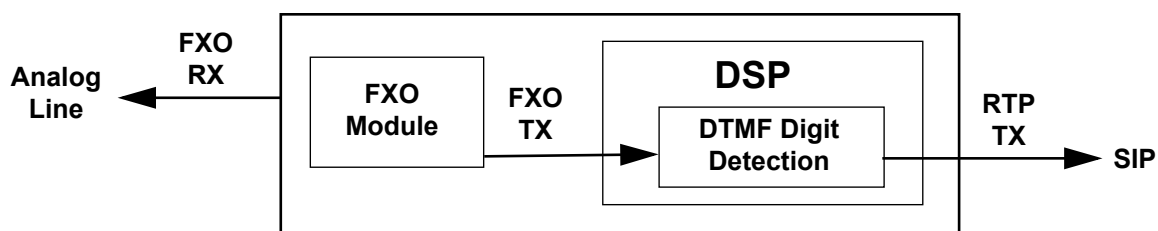
- FXO receive (RX) gain is applied to audio received from the DSP and transmitted out the FXO interface.
- FXO transmit (TX) gain is applied to audio transmitted to the DSP after being received from the FXO interface. This gain change affects audio prior to DTMF digit detection within the DSP.
- RTP transmit (TX) gain is applied after DTMF digit detection.

Common low ERL values are between 5 and 10 dB. Acceptable ERL values begin around 12 dB. The higher the ERL value, the more gain adjustment can be made without introducing echo on the line.

Hardware and Software Requirements and Limitations

The ERL tool can be initiated from the AOS command line interface (CLI) or from the web-based graphical user interface (GUI). This tool is available on AOS products as outlined in the *AOS Feature Matrix*, available online at http://supportforums.adtran.com.

During initial installation, the Installation Wizard prompts the user to automatically tune the FXO lines for best quality. Not all products support the Installation Wizard.

Initiating the Automated ERL Test from the CLI

Once all prerequisites are met, initiate the ERL test by issuing the **test erl** command from the appropriate FXO interface configuration mode. ADTRAN recommends using the command with the **auto-set** parameter to automatically configure the best measured impedance setting for the interface. Use the following steps to start the test:

1. Access the CLI.

2. Enter the FXO interface to be tested (for example **interface fxo 1/1**).

3. Initiate the ERL tool using the **test erl all auto-set** command. This test may take a few minutes to complete.

4. Once the testing is complete, a message displays indicating that the best impedance was selected and the interface was configured with this value.

5. Save the configuration to retain any settings that were automatically applied.

The following is an example of these commands issued in sequence and the resulting message:

#enable
#configure terminal
(config)#**interface fxo 1/1**
(config-fxo 1/1)#**test erl all auto-set**
(config-fxo 1/1)#
2011.12.28 14:28:55 ERL.INFO fxo 1/1 Configuration has been automatically updated
Appropriate commands must be issued to preserve configuration
2011.12.28 14:28:55 ERL.INFO fxo 1/1 erl test finished
(config-fxo 1/1)#do write

Displaying Test Results through the CLI

Detailed test results are displayed from the CLI using one of the following three methods:

1. To view the results in real time, use the **debug voice erltool info** command as described in *Troubleshooting on page 11*.

2. A current snapshot of the status is provided using the **test erl display-results** command issued during the test. The following example displays a periodic update during the testing process:

(config-fxo 0/1)#**test erl display-results**

Port	Impedance	Status	Measured ERL
fxo 0/1	600c		10 dB
fxo 0/1	900r		8 dB
fxo 0/1	900c		9 dB
fxo 0/1	z1		13 dB
fxo 0/1	z2		11 dB
fxo 0/1	z3		14 dB
fxo 0/1	z4		12 dB
fxo 0/1	z5	test calling	

3. The measured ERL value can be viewed by issuing the **show interface fxo** *<slot/port>* command (where *<slot/port>* is the module slot and port) from the Enable mode. The following example displays the results for the FXO 0/2 interface:

#show interface fxo 0/2

fxo 0/2 is UP

  Two-wire Status: Onhook

  Test Status: INACTIVE

   No Tests

  Impedance: 600 ohms +2.16uF

  Transmit Gain: 4 dB

  Receive Gain: 0 dB

  Measured ERL: 14 dB

> **NOTE**
> *The displayed **Measured ERL** corresponds to the result table entry for the configured impedance. If the impedance setting is changed, the displayed **Measured ERL** changes accordingly. If there is no corresponding result, **Measured ERL not available** is displayed instead.*

Initiating the Automated ERL Test from the GUI

AOS has a user-friendly GUI that can be used to perform many basic management and configuration functions on the AOS product. Once all prerequisites are met, access the GUI and initiate the ERL tool using the following steps:

1. Open a new web page in your Internet browser.

2. Enter your AOS product's IPv4 address in the browser's address field in the format **http://***<ip address>***/admin**, for example:

http://10.10.10.1/admin

3. At the prompt, enter your user name and password and select **OK**.

> **NOTE** *The default user name is **admin** and the default password is **password**.*

4. Once connected to the GUI, navigate to **Voice** > **Trunks > Trunk Accounts** menu.

5. Select the appropriate trunk name to access the trunk account settings.

Navigate to **Voice > Trunks > Trunk Accounts.**

Select the trunk name from the list of trunk accounts.

6. Scroll to the bottom of the **Edit Trunk** menu and select the **Port** tab, if not already active.

7. Select the port(s) to run the ERL tool against from the list of connected ports.

8. Select **Tune analog trunks** button to initiate the ERL tool. This test may take a few minutes to complete.
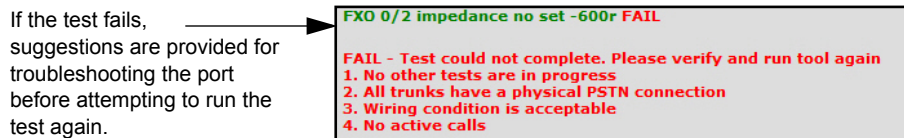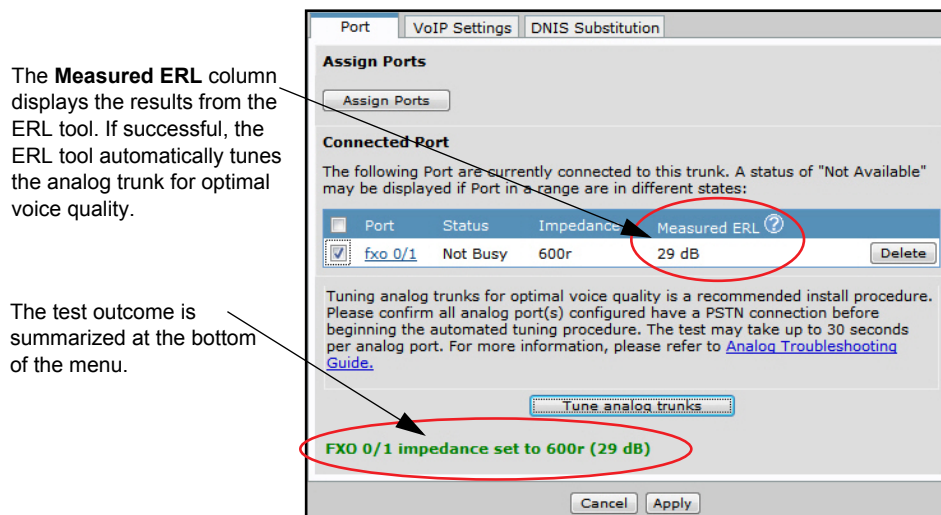
Select the ports from the list.

Select **Tune analog trunks** to initiate the ERL tool.

9. Once the testing is complete, a message displays indicating that the best impedance was selected and the interface was configured with this value.

10. Select **Apply** to save the configuration and retain any settings that were automatically applied.

Displaying Test Results from the GUI

A brief summary of the test results is displayed after the test is run through the GUI. In the following figure, the ERL tool was used to tune two ports. The first test was successful for port **fxo 0/1** and set the impedance to 600r with a measured ERL of 29 dB. However, the second test for port **fxo 0/2** failed to complete the test and shows a FAIL status.

The **Measured ERL** column displays the results from the ERL tool. If successful, the ERL tool automatically tunes the analog trunk for optimal voice quality.

The test outcome is summarized at the bottom of the menu.

If the test fails, suggestions are provided for troubleshooting the port before attempting to run the test again.

Understanding the Test Results

Once the test is complete, the test results are stored in a database table of results that persists until the system is rebooted.

The measured ERL for each impedance setting is used to determine which setting is best for the line. In the case of ERL, the higher the measured value, the better.

See the table below for acceptable ERL values.

Value	Level	Notes
Less than 10 dB	Unacceptable	Check wiring and connections, then contact service provider.
10 dB to 12 dB	Borderline Acceptable	Usable, but gain changes are very limited
12 dB to 16 dB	Acceptable	Refer to *Adjusting the FXO and RTP Gains on page 7*.
16 dB and above	Good	Refer to *Adjusting the FXO and RTP Gains on page 7*.

Errors and Warnings

During test execution, a warning is issued if a test sequence terminates abnormally. Reasons for early termination include:

- The line cannot be seized.
- The line disconnects during test.
- DSP times out (for example, when the DSP hardware version does not support the automated method).
- The test runs for more than 20 seconds per impedance value (for example, 80 seconds with an impedance setting of 4).

The following error is a result of attempting to measure ERL when a measurement sequence is already active.

% could not run erl test

Adjusting the FXO and RTP Gains

Increasing the FXO transmit gain value will increase the volume of the signal being transmitted to the DSP. Decreasing the transmit gain value, will decrease the volume of the signal being transmitted to the DSP. Likewise, increasing the receive gain value will increase the volume of the signal being transmitted out the port. Decreasing the receive gain value will decrease the volume of the signal being transmitted out the port.

Adjustments to the FXO transmit and receive gains can be made either through the GUI or the CLI. Steps for both are provided in the following sections:

- *Configuring FXO Transmit and Receive Gains through the GUI*
- *Configuring FXO Transmit and Receive Gains from the CLI on page 9*

Adjustments to the RTP transmit and receive gains can be made either through the GUI or the CLI. Steps for both are provided in the following sections:

- *Configuring RTP Transmit Gain through the GUI on page 9*
- *Configuring RTP Transmit Gain from the CLI on page 10*

> **NOTE**
>
> *ADTRAN recommends that the difference of the measured ERL minus the sum of the FXO transmit and receive gains should not be less than 10 dB. For example, if the measured ERL is 14 dB and the adjusted FXO transmit gain is +2 dB and the adjusted FXO receive gain is +2 dB, the difference would be 10 dB (14 - [2 + 2] = 10).*

Configuring FXO Transmit and Receive Gains through the GUI

1. Access the GUI from your browser.

2. Once connected, navigate to **System** > **Physical Interfaces** menu.

3. Select the appropriate FXO interface for the Trunk Account.

Select an FXO interface.
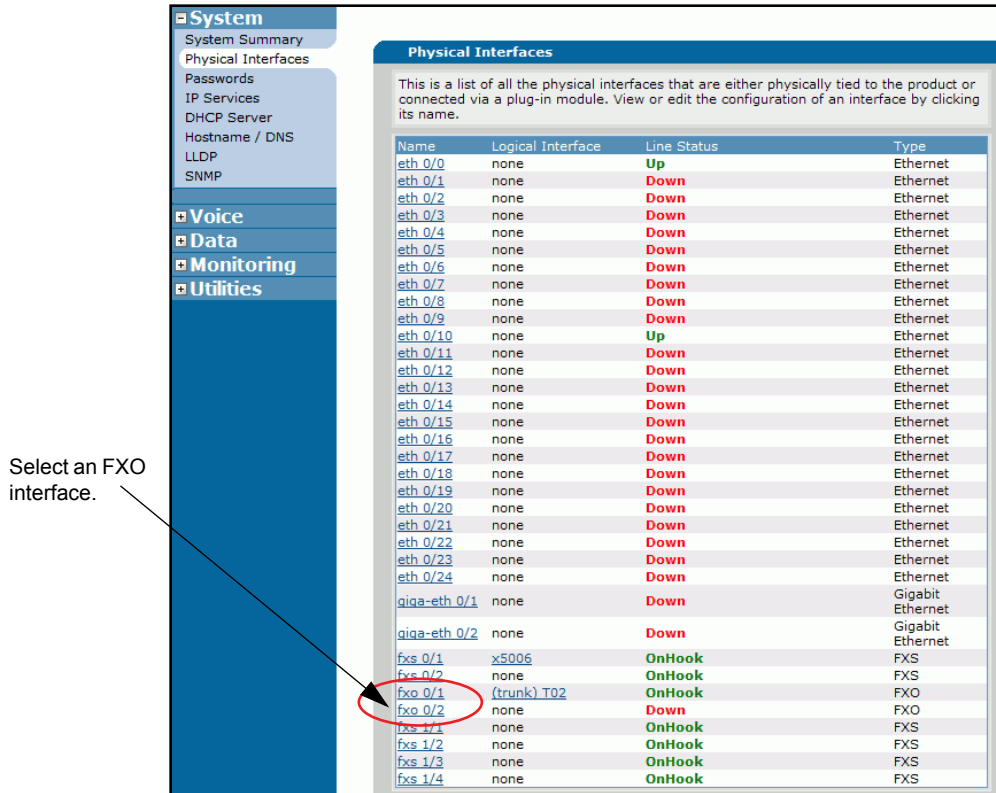
4. Enter the appropriate **Receive Gain** or **Transmit Gain** based on the guidelines provided in *Troubleshooting on page 11*. Impedance will have already been configured by the ERL Tool, so it should not be changed manually after ERL testing.

Enter the **Receive Gain** or **Transmit Gain** as necessary for this FXO line.

Select **Apply** to accept the changes.
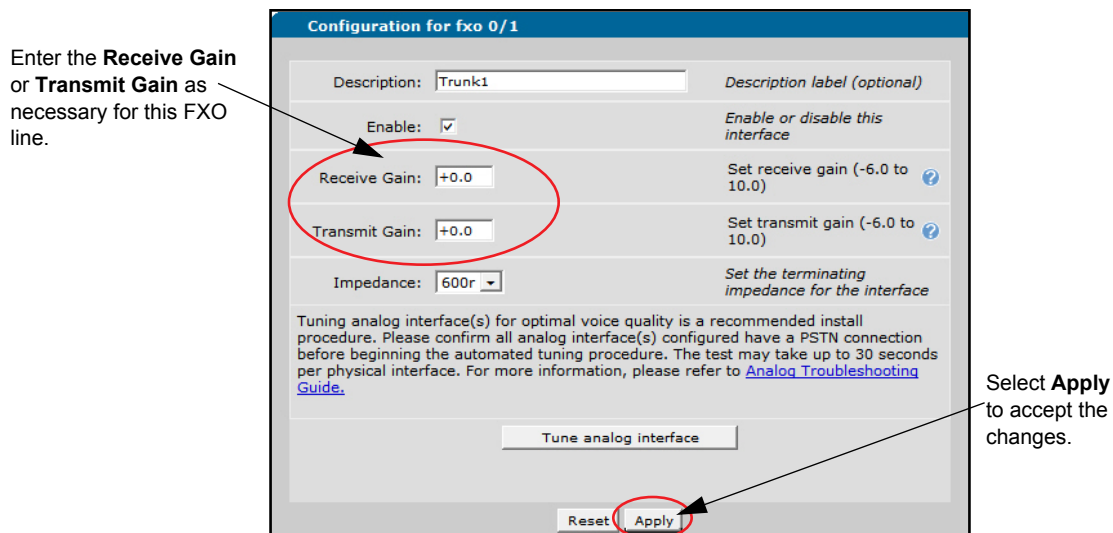
5. Select **Apply** to save the settings.

Configuring FXO Transmit and Receive Gains from the CLI
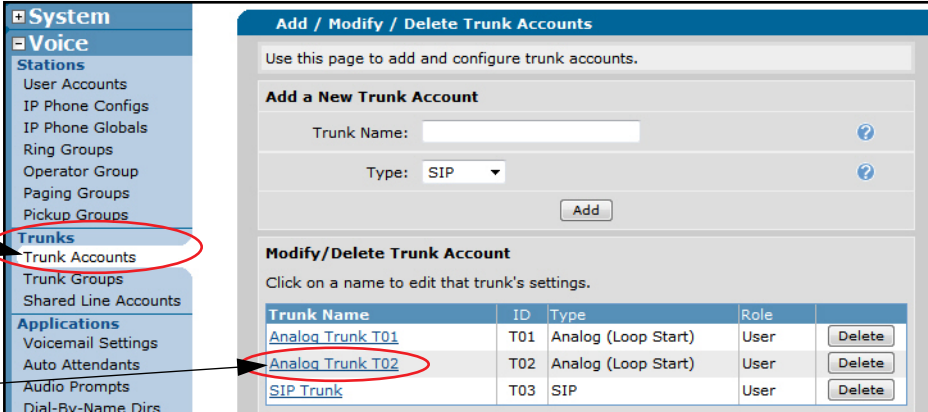
1. Access the CLI and, in the Global configuration mode, enter the FXO interface to be configured (**interface fxo** *<slot/port>*), for example:

   (config)#**interface fxo 1/1**

2. Enter changes to the FXO transmit gain using the **tx-gain** *<value>* command or the FXO receive gain using the **rx-gain** *<value>* command. The *<value>* parameter defines the gain in 0.1 decibel increments. The valid range for *<value>* is **-6.0** to **10.0** dB. The following example defines the transmit gain as +3.0 dB and the receive gain as -1.0 dB:

   (config-fxo 1/1)#**tx-gain +3**

   (config-fxo 1/1)#**rx-gain -1**

3. Once the FXO transmit and receive gains are adjusted, enter **end** to exit the configuration mode.

4. Save the configuration using the **write** command.

Configuring RTP Transmit Gain through the GUI

1. Access the GUI from your browser.

2. Once connected to the unit through the GUI, navigate to **Voice** > **Trunks > Trunk Accounts** menu.

3. Select the appropriate Trunk Name to access the Trunk Account settings.

4. Scroll to the bottom of the **Edit Trunk** menu and select the **VoIP Settings** tab.

5. Enter a value for the RTP transmit gain at the bottom of the **VoIP Settings** menu. The **RTP Transmit (TX) Gain** parameter defines the gain in the time division multiplexing (TDM) to RTP direction. RTP transmit (tx) gain is applied post DTMF digit detection towards the SIP Phone. It is applied from the trunk on the inbound direction. The valid range is **6** to **-14** dB. Negative values specify attenuation. Positive values specify gain in dB.

Enter a value for the RTP Transmit (TX) Gain.

Select **Apply** to accept the changes.

6. Select **Apply** to save the settings.

Configuring RTP Transmit Gain from the CLI

RTP transmit gain can be configured within the trunk account from the CLI.

1. Access the CLI. From the Global configuration mode, enter the trunk account to be configured (**voice trunk** *<Txx>*), for example:

   (config)#**voice trunk T01**

2. Enter changes to the RTP transmit gain using the **rtp tx-gain** *<value>* command. The *<value>* parameter defines the gain in the time division multiplexing (TDM) to RTP direction. The valid range for *<value>* is **6** to -**14** dB. Negative values specify attenuation. Positive values specify gain in dB. The following example defines the RTP transmit gain as 3 dB:

   (config-T01)#**rtp tx-gain 3**

3. Once the RTP transmit gain is adjusted, enter **end** to exit the voice trunk configuration mode.

4. Save the configuration using the **write** command.

Troubleshooting

The following are some common analog line issues and suggestions for correcting the problems detected. Refer to the section that applies to your particular issue:

> **NOTE**
>
> *ADTRAN recommends that the difference of the measured ERL minus the sum of the FXO transmit and receive gains should not be less than 10 dB. For example, if the measured ERL is 14 dB and the adjusted FXO transmit gain is +2 dB and the adjusted FXO receive gain is +2 dB, the difference would be 10 dB (14 - [2 + 2] = 10).*

Callers cannot reach extensions from the auto attendant

This issue most commonly results in callers reaching an auto attendant, dialing digits for an option, and being routed to an incorrect destination, such as an operator. The cause of this issue could be that the digits are not being detected by the auto attendant correctly because either the volume is too low or there is noise on the line.

> **NOTE**
>
> *It is important to ensure that the correct impedance is configured. Refer to Initiating the Automated ERL Test from the CLI on page 3 for instructions.*

To adjust a low volume level, use the following steps:

1. Increase the FXO transmit gain. By default, the FXO transmit gain is set to 0 dB. ADTRAN recommends increasing the FXO transmit gain in 1 dB increments and testing each setting.

> **NOTE**
>
> *Increasing FXO transmit gain affects inbound audio level. Gains above +6 dB are generally not recommended, unless directed by ADTRAN Technical Support.*

> **NOTE**
>
> *ADTRAN recommends that the difference of the measured ERL minus the sum of the FXO transmit and receive gains should not be less than 10 dB. For example, if the measured ERL is 14 dB and the adjusted FXO transmit gain is +2 dB and the adjusted FXO receive gain is +2 dB, the difference would be 10 dB (14 - [2 + 2] = 10).*

2. Place test calls to evaluate whether digits are properly detected. If not, repeat the previous step.

3. Once a working gain level is achieved, save the configuration.

Constant buzzing sound heard over call audio

The most common cause for this issue is related to digital subscriber line (DSL). The DSL line may not necessarily be one of the lines used by the customer themselves. It can be in the same cable bundle delivered to other customers in the same area, but not properly shielded. Since the AOS voice products do not include built-in DSL frequency filtering, external filters must be applied.

Use the following steps to resolve this issue:

1. Place a test call over each line from the AOS unit to determine if buzzing is heard. A phone directly connected to the line will not produce the buzzing sound because it is out of the frequency range of human hearing.

2. For each line where the sound is heard, apply standard DSL filters.

Local Echo

Local echo is experienced on a call when a user hears their own voice echoed back in their handset, usually with a delay. Echo is caused by reflection of the outbound audio signal back to the FXO interface. While not uncommon with analog lines, it can sometimes prove difficult to resolve. Fortunately, the AOS voice products have echo cancellation capabilities in the product's DSP that along with gain adjustments, can resolve this issue.

> **NOTE** *It is important to ensure that the correct impedance is configured. Refer to Initiating the Automated ERL Test from the CLI on page 3 for instructions.*

Use the following steps to resolve this issue:

1. Reduce the FXO receive gain. Since the amount of echo is affected by the signal level outbound on the FXO interface, the FXO receive gain can be adjusted to reduce or eliminate echo. By default, the FXO receive gain is set to 0 dB. ADTRAN recommends reducing the FXO receive gain in 1 dB increments and testing with each setting.

2. Place test calls to evaluate whether echo is still heard. If so, repeat the previous step.

> **NOTE** *Reducing FXO receive gain affects outbound audio level. Gains below -3 dB are not recommended, unless directed by ADTRAN Technical Support.*

3. If the echo is eliminated by reducing FXO gain, save the configuration.

Low Volume

Analog lines delivered over long distances or with significant loss in the path can result in low volume in either direction. Adjusting the transmit or receive gains can compensate for some of this loss.

> **NOTE** *It is important to ensure that the correct impedance is configured. Refer to Initiating the Automated ERL Test from the CLI on page 3 for instructions.*

Low inbound audio volume

1. Increase the FXO transmit gain. By default, the FXO transmit gain is set to 0 dB. ADTRAN recommends increasing the value in 1 dB increments and testing each setting.

> **NOTE** *Increasing FXO transmit gain affects inbound audio level. Gains above +6 dB are generally not recommended, unless directed by ADTRAN Technical Support.*

> **NOTE** *ADTRAN recommends that the difference of the measured ERL minus the sum of the FXO transmit and receive gains should not be less than 10 dB. For example, if the measured ERL is 14 dB and the adjusted FXO transmit gain is +2 dB and the adjusted FXO receive gain is +2 dB, the difference would be 10 dB (14 - [2 + 2] = 10).*

2. Place test calls to evaluate whether the audio is acceptable. If not, repeat until the limit described in the note above is reached.

3. If the volume is still not acceptable, increase the RTP transmit gain.

4. Save the configuration using the **write** command.

Low outbound audio volume

1. Increase the FXO receive gain. By default, the FXO receive gain is set to 0 dB. ADTRAN recommends increasing the value in 1 dB increments and testing each setting.

> **NOTE** *It is important to remember that increasing FXO receive gain also affects outbound audio level and that increasing this gain can introduce echo. For this reason, gains above +3 dB are generally not recommended unless directed by ADTRAN Technical Support.*

> **NOTE** *ADTRAN recommends that the difference of the measured ERL minus the sum of the FXO transmit and receive gains should not be less than 10 dB. For example, if the measured ERL is 14 dB and the adjusted FXO transmit gain is +2 dB and the adjusted FXO receive gain is +2 dB, the difference would be 10 dB (14 - [2 + 2] = 10).*

2. Place test calls to evaluate whether the audio is acceptable. If not, repeat the previous step.

3. When the audio is acceptable, save the configuration using the **write** command.

Static

Static on the line is usually caused by a fault in wiring rather than with the configuration of the AOS unit.

Use the following steps to resolve this issue:

1. Place a test call over each line from the unit to determine if static is heard.
2. For the lines that have static:
   a. Disconnect the line from the AOS unit.
   b. Connect the line to a standard analog phone.
   c. Place a test call and verify whether static is heard.
3. If static is still heard on the analog phone:
   a. Check the cable connecting to the AOS unit
   b. Check the demarcation point or punch-down block for poor connections.
   c. Contact the service provider or wiring contractor for extended demarcation points.

White noise heard when speaking

This condition occurs most often when the user is speaking at the same time as the caller or while hold music or auto attendant greetings are playing. The white noise heard is residual echo that could not fully be cancelled without additional DSP resources. Enabling advanced non-linear processing (ANLP) in the AOS unit accesses additional resources to properly cancel this residual echo. The ANLP feature can be enabled for the trunk account and all user accounts. This feature can only be enabled from the CLI.

Use the following steps to resolve this issue:

1. Access the CLI and, in the Global configuration mode, enter the Trunk Account to be configured (for example **voice trunk T01**). For example:

   (config)#**voice trunk T01**

2. Enable ANLP by entering the **anlp** command, for example:

   (config-T01)#**anlp**

3. Access the desired Voice User Configuration mode by entering the **voice user** <*extension*> command. For example:

   (config)#**voice user 4444**

   (config-4444)#

4. Enable ANLP by entering the **anlp** command, for example:

   (config-4444)#**anlp**

5. Place test calls to ensure the issue is resolved.
6. Save the configuration using the **write** command.

Monitoring ERL Testing with Debug Messages

You can monitor the progress of the ERL testing using the **debug voice erltool info** command from Enable mode. Debug messages are displayed (real time) on the terminal screen. Use the **no** form of this command to disable the debug messages.

> 📝 *NOTE*   *Turning on a large amount of debug information can adversely affect the performance of your unit.*

The following is an example of the output from initiating the ERL measurement tool with **debug voice erltool info** enabled:

```
(config-fxo 0/1)#test erl all auto-set
12:24:50 ERL.INFO fxo 0/1 erl measurement started, using impedance 600c
12:24:55 ERL.INFO fxo 0/1 impedance 600c - measured erl 14 dB
12:24:55 ERL.INFO fxo 0/1 erl measurement started, using impedance 900r
12:25:00 ERL.INFO fxo 0/1 impedance 900r - measured erl 25 dB
12:25:00 ERL.INFO fxo 0/1 erl measurement started, using impedance 900c
12:25:05 ERL.INFO fxo 0/1 impedance 900c - measured erl 20 dB
12:25:05 ERL.INFO fxo 0/1 erl measurement started, using impedance z1
12:25:11 ERL.INFO fxo 0/1 impedance z1 - measured erl 10 dB
12:25:11 ERL.INFO fxo 0/1 erl measurement started, using impedance z2
12:25:16 ERL.INFO fxo 0/1 impedance z2 - measured erl 10 dB
12:25:16 ERL.INFO fxo 0/1 erl measurement started, using impedance z3
12:25:21 ERL.INFO fxo 0/1 impedance z3 - measured erl 10 dB
12:25:21 ERL.INFO fxo 0/1 erl measurement started, using impedance z4
12:25:27 ERL.INFO fxo 0/1 impedance z4 - measured erl 8 dB
12:25:27 ERL.INFO fxo 0/1 erl measurement started, using impedance z5
12:25:32 ERL.INFO fxo 0/1 impedance z5 - measured erl 9 dB
12:25:32 ERL.INFO fxo 0/1 erl measurement started, using impedance z6
12:25:37 ERL.INFO fxo 0/1 impedance z6 - measured erl 10 dB
12:25:37 ERL.INFO fxo 0/1 erl measurement started, using impedance z7
12:25:43 ERL.INFO fxo 0/1 impedance z7 - measured erl 12 dB
12:25:43 ERL.INFO fxo 0/1 erl measurement started, using impedance 600r
12:25:48 ERL.INFO fxo 0/1 impedance 600r - measured erl 15 dB
12:25:48 ERL.INFO fxo 0/1 Best result is 25 dB using impedance setting 900r
2008.08.21 12:25:48 ERL.INFO fxo 0/1 Configuration has been automatically updated
Appropriate commands must be issued to preserve configuration
2008.08.21 12:25:48 ERL.INFO fxo 0/1 erl test finished
```

Additional Resources

Additional resources are available to aid in configuring your AOS unit. The documents listed below are available online at ADTRAN's Support Forum at https://supportforums.adtran.com.

•   *Configuring NetVanta 7000 Series Trunk Accounts*
•   *AOS Command Reference Guide*