Pandora

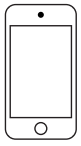
Loudness Analyzer

User Guide
Software Version: V2.30

Part Number 821018, Revision J

**Pandora requires an Apple iPod touch®
(4th generation)
which is not included with the unit.**

Made for iPod



iPod touch
4th generation
8GB 32GB 64GB

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This document is intended to be printed on a duplex printer, such that the copy appears on both sides of each page. This ensures that all new chapters start on a right-facing page.

This document looks best when printed on a color printer since some images may be indistinct when printed on a black and white printer.

Other Technologies and Products

“Made for iPod” means that an electronic accessory has been designed to connect specifically to iPod, and has been certified by the developer to meet Apple performance standards. Apple is not responsible for the operation of this device or its compliance with safety and regulatory standards. Please note that the use of this accessory with iPod may affect wireless performance.

Last Update

May 23, 2012

Table of Contents

Preface

Introduction

Overview

The preface lists the new features and functionality for the V2.30 release.

Topics

What Is Loudness?

The familiar audio metering standards of VU and Quasi-PPM, developed in the 1930's for telephone and radio signal measurements, were conceived before more recent psychoacoustic research defined the true characteristics of human hearing response across different frequencies, listening levels and listening time periods. The 300 milliseconds response time of the VU meter, originally useful for voice level measurements in telephony and tape head saturation in music recordings, only roughly approximates the perceived loudness we hear. The quicker 5-10 milliseconds response times of (Quasi-)PPM meters, while much better than VU for measuring the clipping or saturation potential of transient peaks, is actually less useful as a loudness meter.

Their continued use in digital audio applications was mostly for lack of something better and familiarity, rather than defining new audio level measurements suitable for the greater amplitude dynamic range and frequency bandwidth afforded by the digital audio equipment now used predominantly by television producers and broadcasters. In response to television viewer objections worldwide, the broadcast community has developed new loudness and peak level metering standards for industry users to accurately measure and standardize their audio levels across channels, programs and breaks.

Loudness Units (LU) are relative to a reference level (defined by the ITU or EBU standard chosen) in dB. LU is replacing VU for listening level measurements because of its strong correlation with perceived loudness as confirmed by listening studies. LU meters' nominal target level is zero (0) as with VU meters. LKFS and LUFS are the absolute units as named in ITU and EBU standards, respectively, and are negative numbers in dB below 0 dBFS maximum on equivalent digital scales.

True Peak (TP) measurements are made by 4x oversampling the audio signals so that all but the shortest peaks are more accurately measured. TP is intended to replace PPM measurements for the purpose of maintaining equipment headroom. True Peak units are absolute level negative numbers in dB(TP) equivalent to digital scale dBFS. The maximum allowed TP level being raised above the former PPM threshold reflects its improved accuracy.

Refer to the international standards listed in Appendix B: References on page 61 for more information concerning history and theory of loudness. Or you can just continue reading this manual as needed to

become familiar with the ins and outs of the new metering applications and protocols. What does it all mean in a nutshell? Whether you are in ITU or EBU "governed" countries, keep your Loudness between -22 and -24 (absolute LKFS or LUFS units) and stay below -2 dBTP for any and all peaks— and your audio is within specification.

What's New in Pandora?

In this software release, we listened to your requests and as a result, we have added many new features and functionality.

1. In manual mode, when you press the **Stop** button, the system deletes the fast/momentary/short/integrated number since it is no longer relevant.

2. Integrated loudness is now synchronized with average loudness.

3. The application version number displays at the bottom of the **Setup Menu**.

CHAPTER 1
Installation

Introduction

Overview

This chapter describes the physcial controls and connectors of Pandora as well as how to download and install the software and install the iPod touch into the Pandora case.

Topics

Safety

WARNING: Do not use this equipment near water, rain or moisture.

1. Read, keep, and follow all of these instructions; heed all warnings. Use only a dry cloth to clean the equipment.
2. Do not block any ventilation openings.
3. Do not install near any heat source such as a radiator, heat register, amplifier, or stove.
4. Select the correct wall plug blade adapter corresponding to the power outlet, and install into the power supply provided.
5. Protect the power cord from being walked on or pinched, particularly at plug's source on the equipment and at the socket.
6. Use only the attachments/accessories specified by the manufacturer.
7. Unplug the equipment during lightning storms or when unused for long periods of time.
8. Use of a cart is neither recommended nor approved by Wohler.
9. Refer all servicing to qualified service personnel. Servicing will be required under all of the following conditions:
   - The equipment has been damaged in any way, such as when the power-supply cord or plug is damaged.
   - Objects have fallen onto the equipment; or the equipment has been exposed to rain or moisture, or liquid has been spilled onto the equipment.
   - The equipment does not operate normally.
   - The equipment has been dropped.

FCC Compliance

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful

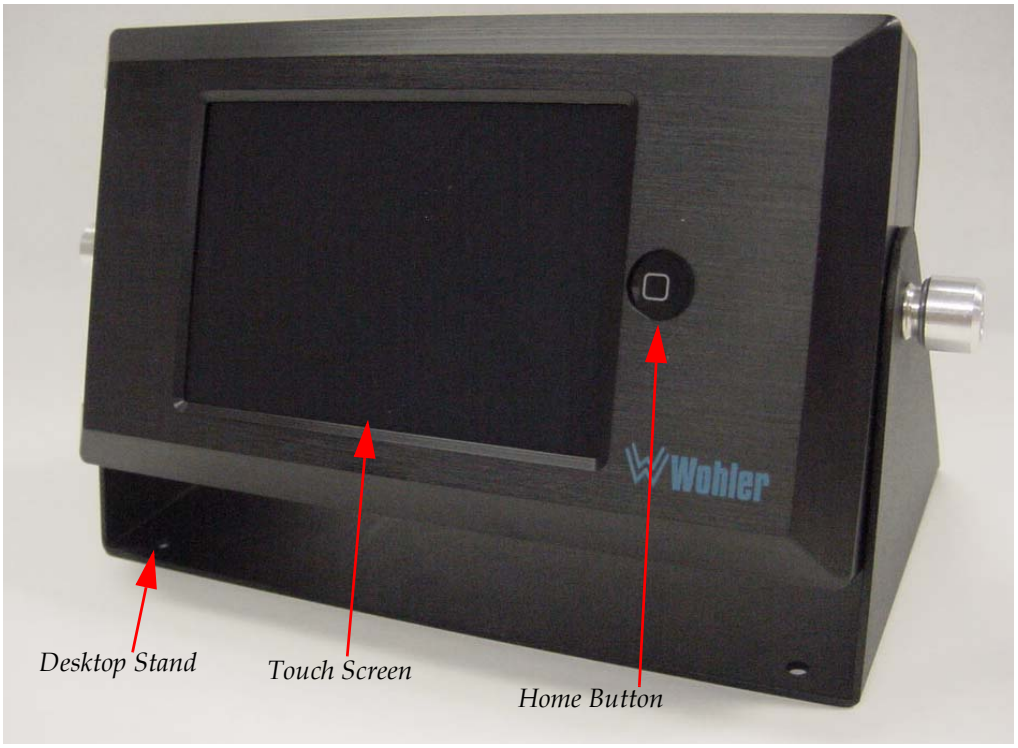
interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Pandora Overview

Front Panel

Pandora's front panel is shown on Figure 1–1 below.

Figure 1–1 Pandora Front Panel



- **Home**: Pressing this button on the Apple iPod touch (not included) displays the application selection menu.

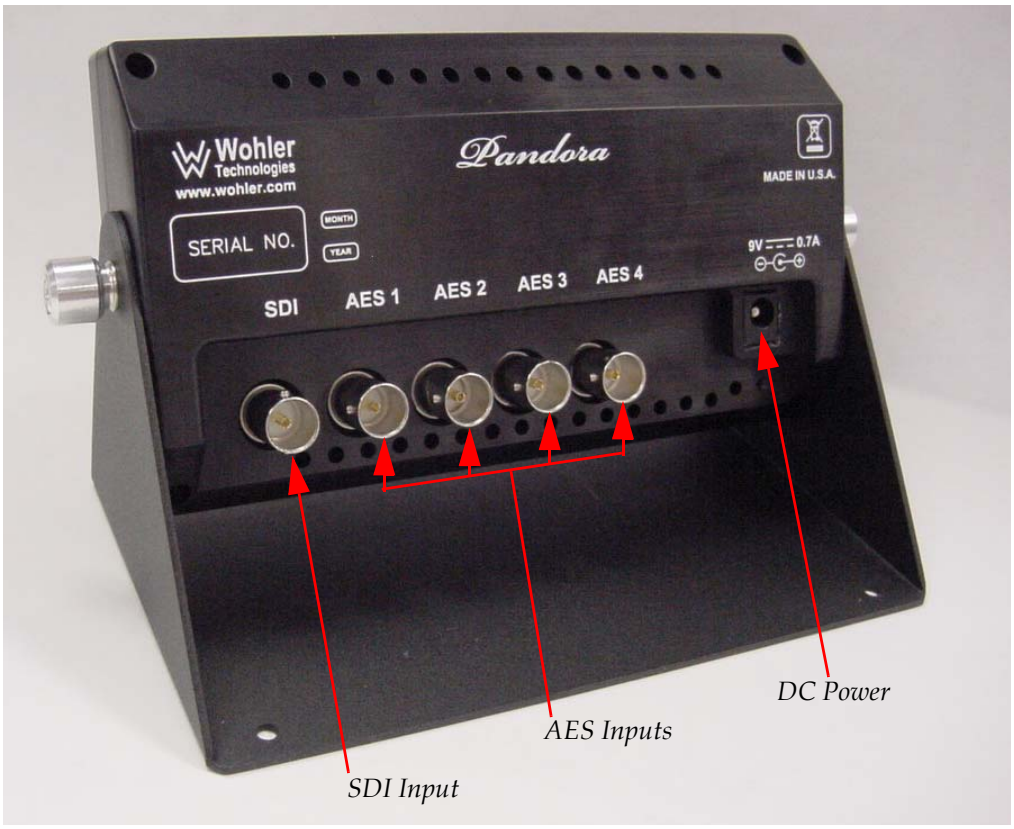
- **Touch Screen**: The screen serves as both the loudness meter display and the touch screen interface through which you configure Pandora. Refer to Configuration on page 15 for details.

- **Desktop Stand**: Pandora comes with a desktop stand pre-installed.

Rear Panel

Pandora's rear panel is shown in Figure 1–2 below.

Figure 1–2 Pandora Rear Panel



- **AES Inputs** (BNC-F, 1 through 4): These four (75 Ω) inputs receive standard signals:
  - Two channels: 1 pair, or
  - 5.1 channels: 3 pairs, or
  - 7.1 channels: 4 pairs.

  When the input signal is two-channel, only **AES In 1** is used. **AES In 1** is the default two channel input for stereo signals, but any

AES In jack can be used after reassignment in **Channel Function** menu.

Note: Pandora does not decode Dolby bitstreams, although it can monitor discrete 5.1 and 7.1 channel configurations.

- **SDI Input** (BNC-F): This (75 Ω) input receives standard 3G/HD/SD-SDI input. Up to eight channels in two groups can be de-embedded and monitored.
- **Power** (DC): Receives a 9 VDC coax-type (center pin positive) power connector.

Installing the Software Upgrade

In this section you will download and copy the free **Wohler Loudness** application from the iTunes **App Store** SM to the iPod.

Requirements

- Mac or PC with an Internet connection
- The USB cable that came with your iPod touch
- The Pandora case and the power supply that came with it
- The iPod touch (4th generation)
- Credit card (for your Apple account if you do not yet have one)

Important: If you do not already have an Apple account, you must first create one. Follow the instructions below.

Otherwise, if you do already have an Apple account, connect the iPod to your computer with the USB cable; launch the iTunes application; and skip to Logging in to the App Store on page 7.

Instructions

Creating an Apple Account

1. Download and install the latest version of **iTunes** from www.iTunes.com/download onto your PC or Mac. (The **iTunes** application is free.)

2. Connect the iPod's USB cable to the iPod touch and to the USB port on your computer.

3. Launch the **iTunes** application on your computer.

4. After your computer recognizes the connected iPod touch, the **iTunes** application will display the **Welcome** screen.

5. When the **Apple ID** screen displays, click **I do not have an Apple ID** and click **Continue**.

6. When the **Register Your iPod** screen appears, fill out the requested information. Note that the screen should display your iPod's serial number. Click **Submit**.

7. When the **Terms and Conditions and Apple Privacy Policy** screen displays, read the terms, check the box at the bottom, and click **Continue**.

8. When the **Create Apple ID** screen appears, enter your password (twice), a security question and answer, and your birth date, and then click **Continue**. Save your ID and password for future use.

9. When the **Provide Payment Information** screen appears, enter your information. Click **Submit**.

Note: You will receive an email in the account you listed in your Apple account verifying your new credentials.

Logging in to the App Store

Decision Point:

You can install the software using your laptop (described in the steps below this decision point) or you can download the software directly to your iPod described in the steps immediately below.

1. Run the App Store app on the iPod touch/iPad.
2. Select the Search tab at the bottom on the application.
3. Enter *Wohler Loudness* in the search field and touch the **Search** button.
4. Select the *Wohler Loudness* app from the list.
5. Touch the **Install** button.
6. Enter your Apple ID password.

1. In the **iTunes** application window, click on the i**Tunes Store** (under **Store**) in the left pane.
2. At the top of the application window, click **App Store**.
3. At the top right corner of the application window, type *wohler* into the **Search Store** field.
4. Click on **wohler loudness**.
5. Click on **FREE**.
6. In the **iTunes** dialog, enter your **Apple ID** and **Password**, then click **Get**. (Wait until the application has downloaded. This process should take less than a minute.
7. When prompted for verification, re-enter your credit card information as needed.
8. Connect the iPod touch to the USB cable that came with it, and connect the other end of the cable to your computer. As soon as your computer recognizes the iPod, it will display the name of the iPod in the **Devices** section (left frame).

Transfering the Wohler Loudness Application into the iPod touch

1. Click the name of your iPod under **Devices** in the left pane.

2. At the bottom right corner of the application window, click **Sync**. Wait for the sync to complete.

3. Before you can disconnect the iPod touch from the USB cable, you need to discontinue communications between the **iTunes** application and the iPod touch. Click the up arrow to the right of the name of the iPod in the **Devices** section (left frame).

Figure 1–3 iTunes Application: Devices

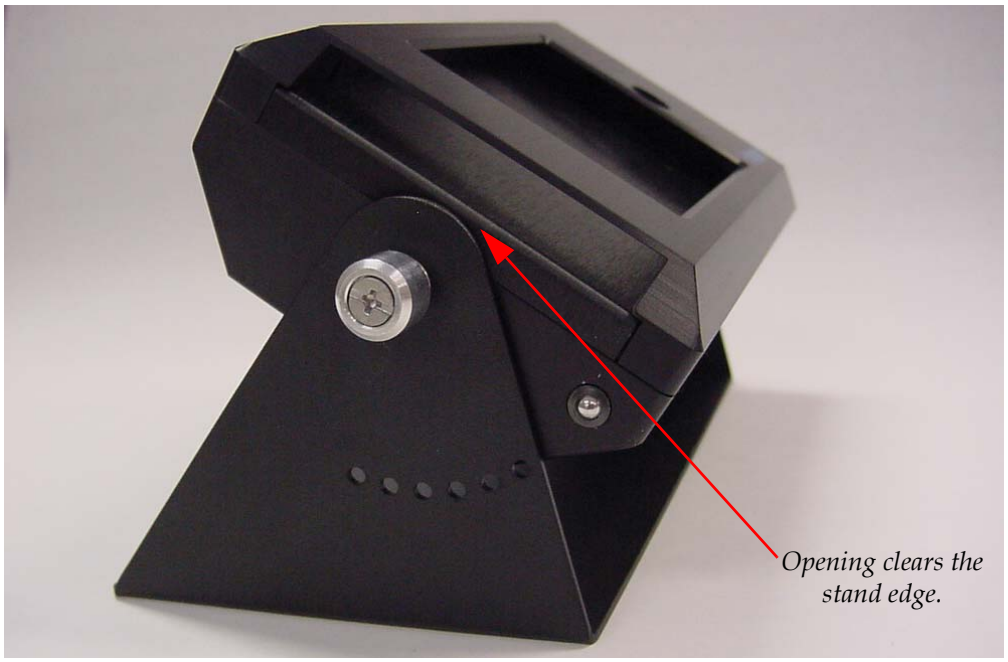
4. Now you can close the **iTunes** application and disconnect the iPod touch from the USB cable.

iPod touch Installation

Pandora comes with a table top stand already attached to the unit.

1. To insert the iPod touch into the Pandora case, rotate the case backward until the opening clears the edge of the stand (Figure 1–4 on page 9).

Figure 1–4 Rotate the Case Backward



2. Gently slide the iPod touch into the case (**Home** button end first) until you feel it engage the internal connector as shown in Figure 1–5.

Figure 1–5 Inserting the iPod touch into the Pandora Case

Note: Newer units will have a hole into which you can insert a set screw to secure the iPod touch into the Pandora case. Insert the set screw into the hole and tighten with the hex wrench provided

3. If you have not already done so, connect the Pandora power supply to the Pandora case and to a power source.

IMPORTANT: For proper hardware operation, always apply power to the Pandora *before* launching the Wohler Loudness application.

4. Place the unit at approximately eye level and tilt the unit in the stand as needed for optimum visibility.

5. Connect a digital audio input source to one or more of the inputs on the rear panel.

Note: For testing purposes, you can run Pandora in **Demo** mode without attached audio sources.

CHAPTER 2
Configuration and Operation

Introduction

Overview

This chapter describes how to configure Pandora for your environment and then it describes in detail the three different modes of operation.

Topics

Initial Setup

Once you have installed the iPod touch into the Pandora case and applied power, you are now ready to launch the application, configure it (if needed) and begin using your Pandora.

1. Press the **Home** button on the front panel to start. Refer to Figure 2–1 below.

Figure 2–1 Pandora Loudness Icon

2. Swipe your finger across the unlock slider to unlock the iPod touch.

Setting the iPod touch Brightness

1. If needed, press the **Home** button, to return to the main screen.
2. Swipe your finger left or right across the screen to display the **Settings** icon.
3. Touch **Settings**.
4. Touch **Brightness**.
5. Touch **Auto-Brightness** so that it displays **OFF**.
6. Then, using your finger, slide the brightness slider to adjust the display brightness.

7. Touch **Settings** at the top left corner.

8. Press the **Home** button to display the main screen.

9. If needed, swipe your finger left or right to locate **Wohler Loudness**.

10. Touch the **W Loudness** icon.

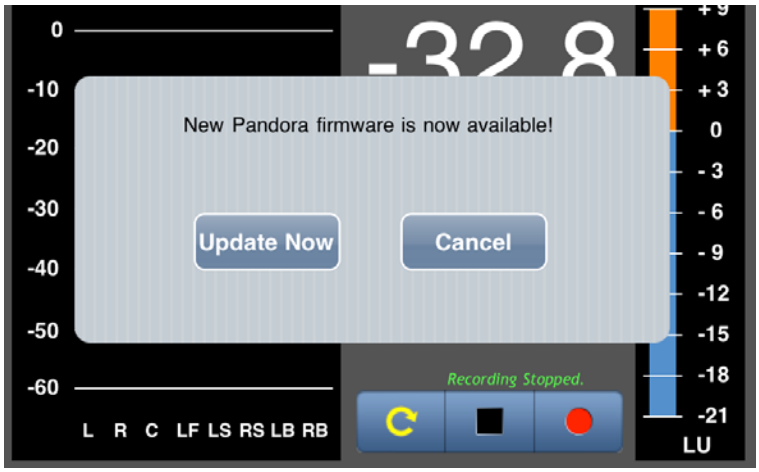
Upgrading the Firmware

Decision Point:

If you see the firmware availability announcement as shown in Figure 2–2 below, then you will have the opportunity to upgrade your firmware in addition to the software application installation you just completed.

Be aware, however, that if you have the original firmware version, you will not be able to download the upgrade; you will have to send your unit back to Wohler.

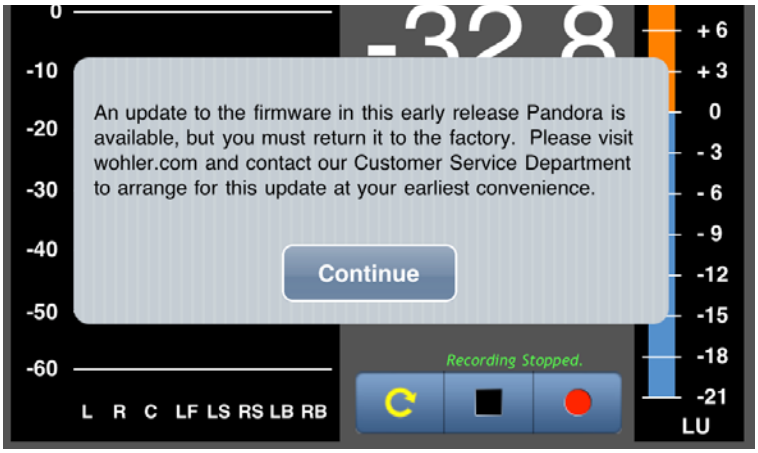
Figure 2–2 New Firmware Available



1. If you see the screen shown in Figure 2–2 above touch **Update Now** to upgrade, or touch **Cancel** to skip to Configuration on page 15.

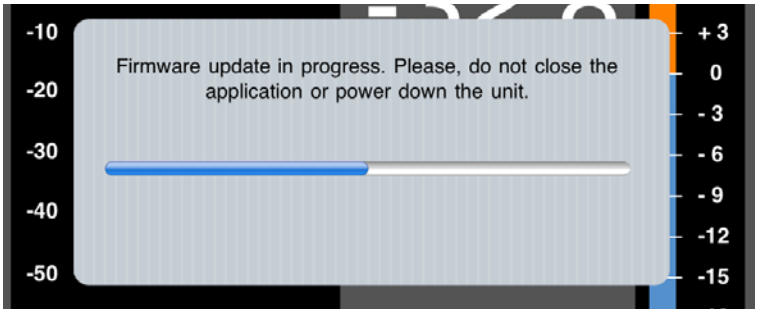
Important: In the event you see the message displayed in Figure 2–3 below, please contact Wohler's customer support for further instructions. Wohler's contact information is on page ii of this document.

Figure 2–3 New Firmware Available - Return to Wohler for Firmware Upgrade



If you did not see the message in Figure 2–3 above, then you should be able to proceed with the firmware upgrade. The screen will display the progress of the software download as shown in Figure 2–4 below.

Figure 2–4 New Firmware Available - Progress Bar

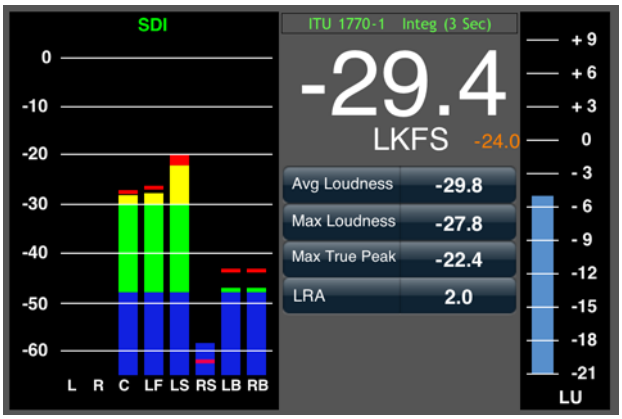


Note: Now that you have all the software installed, your Pandora may work exactly the way you want it to without any further configuration. If you'd like to try it, you can skip the Configuration section below, and go directly to Operation on page 30.

Configuration

The first screen that displays after you select **W Loudness** from the application list is the **Meter Screen** as shown in Figure 2–5 below.

Figure 2–5 Meter Screen



Swipe the screen from top to bottom to display the **Setup Menu** (Figure 2–6 on page 15).

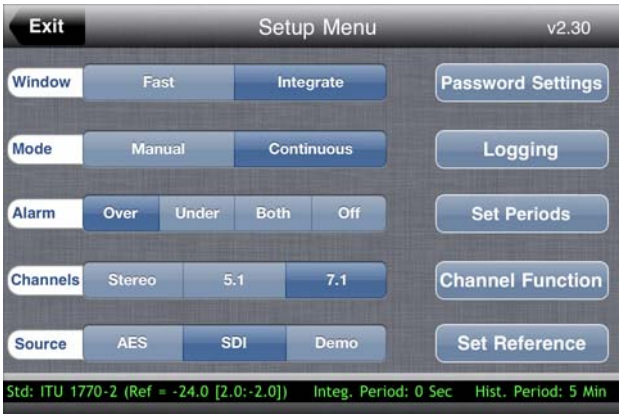
Note: In **Manual** mode, avoid starting a swipe over a control so that you don't accidently change that control.

To configure your Pandora, we'll start with the options at the bottom of the **Setup Menu** and work our way up to the top.

Set Reference

1. On the **Setup Menu** (Figure 2–6 below) touch **Set Reference**.

Figure 2–6 Setup Menu



The **Set Reference** screen is shown in Figure 2–7 below. Here you will select the standard to which you want your loudness values to conform.

Figure 2–7 Set Reference Screen - ITU 1770-1

Note: The ITU 1770 settings include ITU-R BS.1771 and ITU-R BS.1864 (-24 LKFS) international standards which are called out by various regional standards such as ATSC A/85 and ARIB TR-B32. LRA is included as an additional loudness measurement for both ITU configurations, even though it is not required by any BS.1770 version.

As of Feb 2012, ATSC RP A/85 defines ITU-R BS.1770-1 as the operative standard for short form content and the alternate standard for long form content (where Anchor Element is the preferred measurement when possible). ARIB TR-B32, while not fully specific, is more closely aligned with ITU-R BS.1770-2 for all measurements.

The EBU (-23 LUFS) setting is for European standard EBU R128 which requires LRA, has a different target level, and specifies tighter upper/lower limits than the ITU standard.

2. Touch **ITU 1770-1**, **ITU 1770-2**, or **EBU R128**.

   Note: If you select **EBU R128**, you must also then select either the **EBU +9 scale** or the **EBU +18 scale** as shown in Figure 2–8 below.

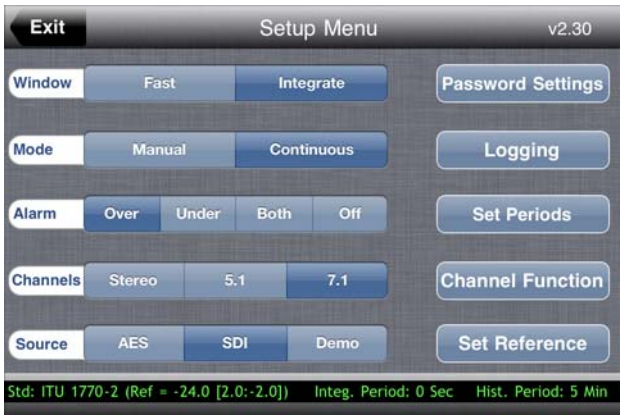
Figure 2–8 Set Reference Screen - EBU

3. The standard default values of the **Reference Level**, **Relative Upper Limit**, and **Relative Lower Limit** are shown. The limits refer to the **Over** and **Under** visual alarm indications. Slide your finger up or down over the rollers to change these values if needed.

   - **Restore**: Restores all three values (**Reference Level**, **Relative Upper Limit** and **Relative Lower Limit**) to their **ITU/EBU** defaults.
   - **Reset**: Resets the entire application to the factory default values.

4. When the correct values are displayed on the center line, touch **Exit** to return to the **Setup Menu**.

Figure 2–9 Setup Menu



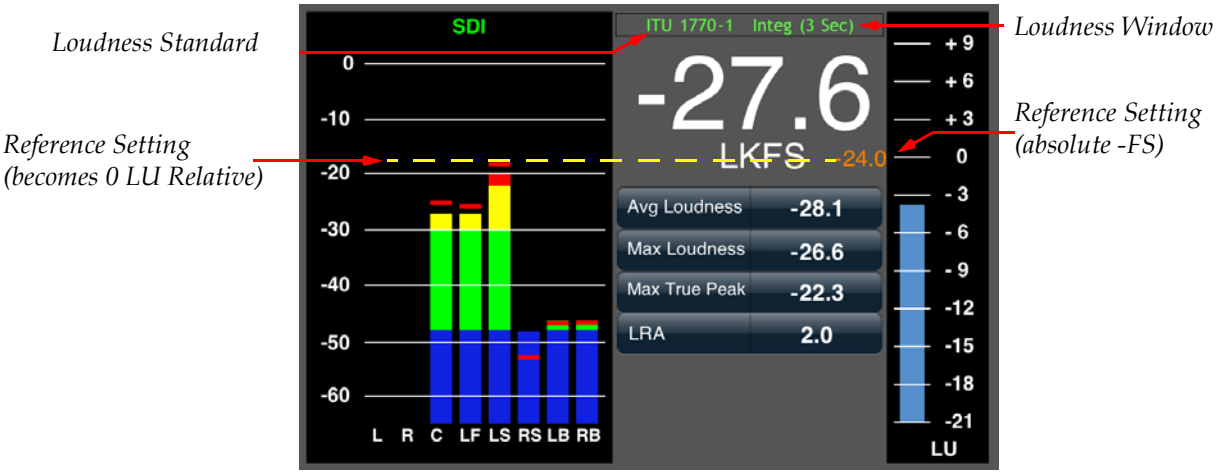
5. Now would also be a good time to determine which visual alarms you want to display. In the Alarm row, select Over, Under, Both, or Off.

- **Over**: Touching **Over** shows all loudness values on the meters, histogram, and numeric display screens that are over your selected **Relative Upper Limit** value in red.
- **Under**: Touching Under shows all loudness values on the meters, histogram, and numeric display screens that are under your selected **Relative Lower Limit** value in blue.
- **Both**: Touching **Both** displays both the **Over** and **Under** alarms as described above.
- **Off**: Touching **Off** turns off both visual alarms.

6. To display the meters screen to view your results, touch **Exit** (Figure 2–10 below).

   Notice at the top line of the meter screen (in green) that the loudness standard (**ITU** or **EBU**) is displayed. If you modified the reference levels, the screen will display **ITU-mod** or **EBU-mod**. Such reference or limit changes will also start a new log file with those values in the log file header.

Figure 2–10 Meter Screen

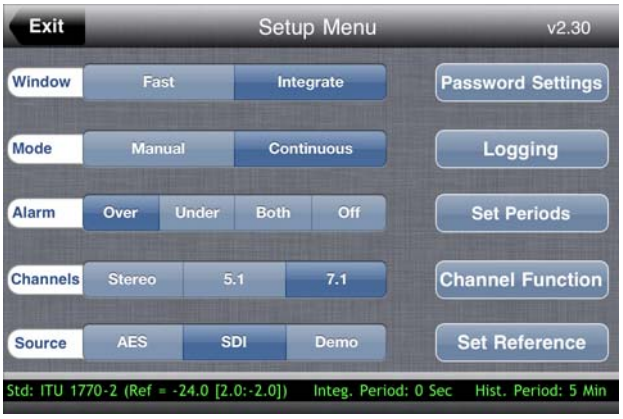


Channel Function

1. Before going into the **Channel Function** screen, touch to select your input source signal from the **Source** row: either **AES** or **SDI**. In our example, we selected **SDI**.

   Note: See Mode on page 28 for a description of **Demo** mode. We will not select it for this example, because selecting **Demo** mode will lock you out of the **Channel Function**.

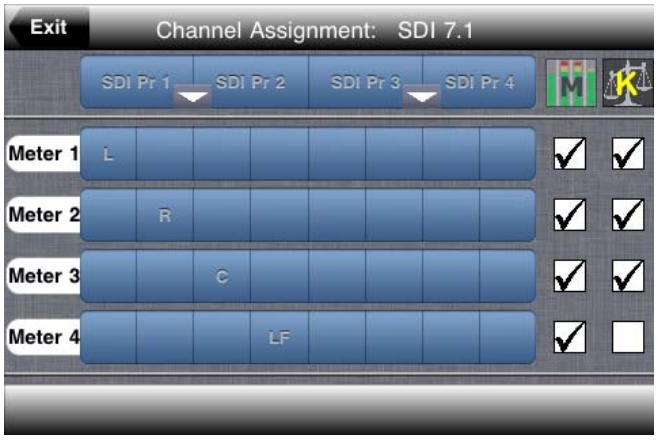
Figure 2–11 Setup Menu



2. From the **Channels** row, touch to select the number of channels you want the meters to display: **Stereo** (2), **5.1** (6), or **7.1** (8). In our example we selected **7.1**.

3. Now touch **Channel Function** to display the **Channel Assignment** screen as shown in Figure 2–12 below.

Figure 2–12 Channel Assignment Screen



- **M (Meters)**: When checked, Pandora will display this meter on the meter screen. In the example in Figure 2–13 below, Meters 1 through 4 will be displayed on the meters screen. To enable or disable the meter display, simply touch the checkbox.

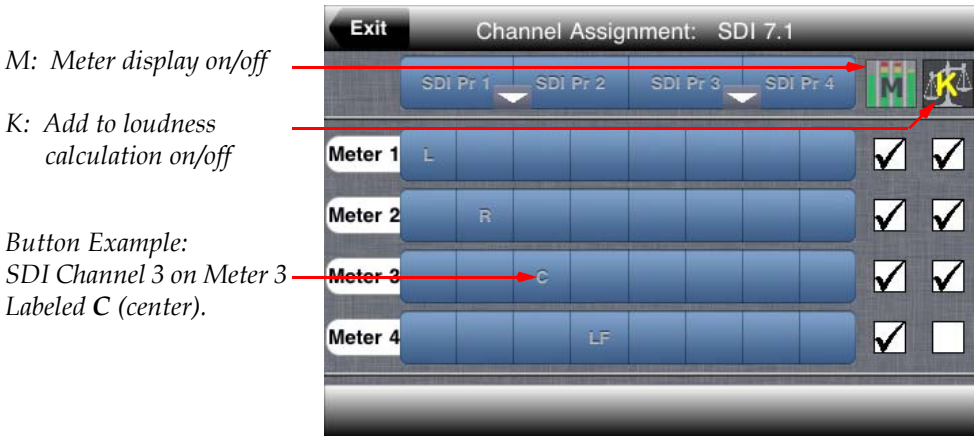
- **K (Weighting)**: When checked, this meter will be multiplied by a value appropriate to the channel type and included in the loudness calculation. In the example in Figure 2–13 below, **Meter 1** is assigned **L**, so it will be weighted by 1.0 before it is added to the loudness calculation. To add the meter to, or eliminate the meter from being added to the loudness calculation, simply touch the checkbox.

Important: By default (ITU & EBU) LF (low frequency) channels will be omitted from the loudness calculation. When a LF channel is assigned K-weighting, its loudness value is increased by 10dB when added to the audio group being measured. The status will be indicated on the meter display and log files as (ITU or EBU) "-mod".

The following weights are the ITU defaults:

- For **L**, **R**, **C** => 1.0 x
- For **LF** => + 10 dB
- For **LS**, **RS**, **LB**, and **RB** = > 1.4 x

Figure 2–13 Channel Assignment Screen

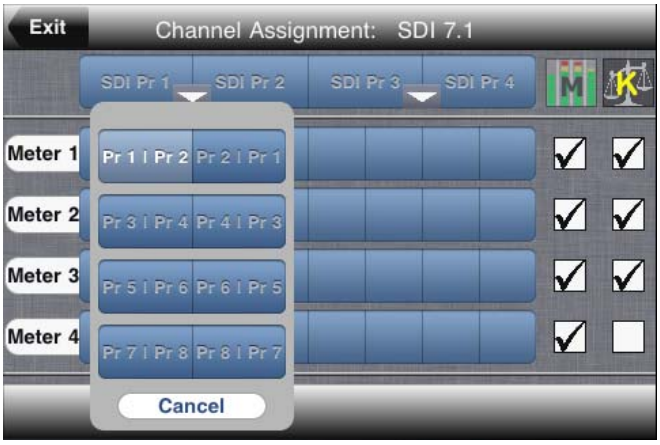


4. To assign a channel to a meter, simply touch the blue button that represents the intersection of both the channel and the meter you want to assign the channel to. In the example in Figure 2–12 on the previous page, Channel 1 is assigned to **Meter 1** as **L**; Channel 2 is assigned to **Meter 2** as **R**; Channel 3 is assigned to **Meter 3** as **C**, and so on.

5. Swipe the screen from bottom to top to display more meter rows.

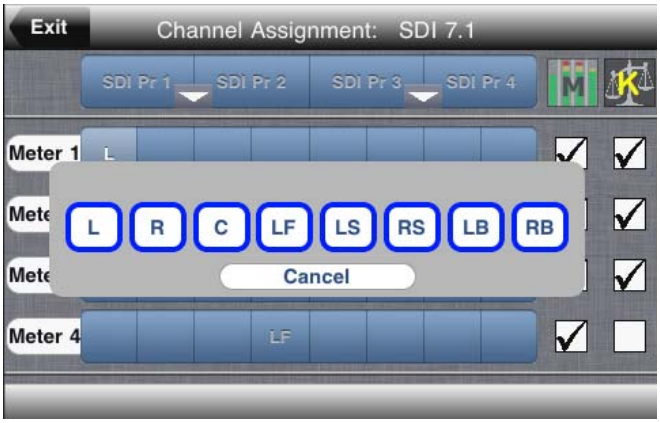
6. If you want to rearrange the order of the channels, touch the down arrrows (between the channel pairs at the top) to select the channel pairs. The channel pair drop-down menu displays as shown in Figure 2–14 below.

Figure 2–14 Channel Assignment Screen Showing Channel Pair Selections for Rearranging



7. Now for each meter, touch the blue boxes to display the channel type list as shown in Figure 2–15 below.

Figure 2–15 Channel Assignment Screen Showing Channel Type List



8. Touch the channel type for this meter (Figure 2–15 on page 21):
   - **L** (left),
   - **R** (right),
   - **C** (center),

- **LF** (low frequency),
- **LS** (left surround),
- **RS** (right surround),
- **LB** (left back), or
- **RB** (right back).

9. When all the inputs are assigned to the correct types and meters, touch **Exit** to return to the **Setup Menu**.

Set Periods

1. From the **Setup Menu** (Figure 2–16 below), touch the **Set Periods** button to display the **Integration and Histogram Periods, and LRA Window** screen (Figure 2–17 bottom).

Figure 2–16 Setup Menu

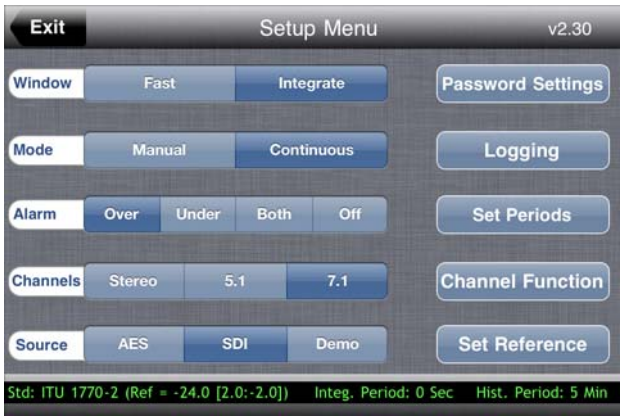
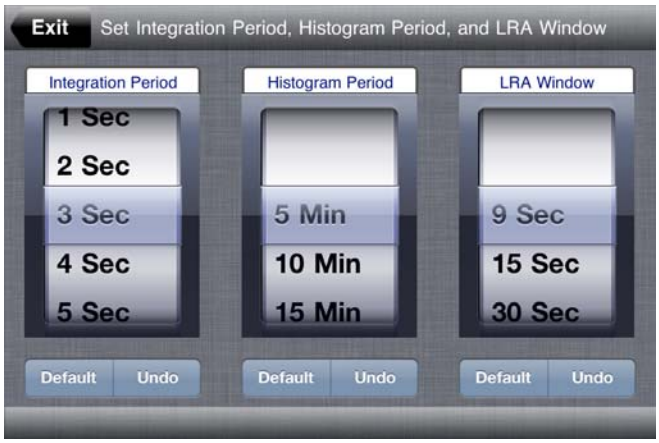


Figure 2–17 Set Integration, Histogram, and LRA Periods



2. Slide your finger up or down over the rollers to change these values if needed. Both period values range from three seconds to one hour.

   - **Default**: Resets the entire application to the factory default.
   - **Undo**: To undo the last value change, press **Undo**.
   - **Integration Period**: This is the period of time for which you want to measure the loudness of a particular signal, typically a program or interstitial (promotion, or announcement). The **Integration Period** setting should correspond to roughly three to five percent (3% to 5%) of the program, interstitial, or broadcast time block of interest.

Example 1 Four percent of a ten second spot would be 0.4 seconds: shorter than the **Integration Period** settings provided. However, this is exactly what **ITU-Fast** and **EBU-Moment**(ary) settings were created for. Only the shortest measurement window can track the loudness levels word-for-word, even syllable-by-syllable, to catch the most annoying loudness jumps between scheduled programs.

Example 2 Four percent of a one hour program (usually about 50 minutes; or 3000 seconds) would be 120 seconds, or 2 minutes.

Example 3 For a broadcaster interested in their daily (average) loudness, 4% of 24 hours (24 minutes x 60 minutes) is 57.6 minutes, or approximately 1 hour.

- **Histogram Period**: This is the period of time for which you want to display loudness data in histogram format. It has no effect on the data-only the graphic presentation.

- **LRA Window**: This is the (most recent) time period for which the loudness range measurement data applies. Very short time periods, of less than 30 seconds, do not really produce enough data points to be statistically valid but are provided anyway.

  The **LRA Window** should be set as close as possible to the actual time block of interest. **Manual** mode LRA measurements begin with the **Start** button and end with the **Stop** button, making this setting irrelevant for measurements made manually.

Note: The loudness range (LRA) and the **LRA Window** are two distinct measurements. The **LRA Window** (described on the previous page) is a duration. The LRA is being calculated and shown in all three standards.

The **ITU** standard does not include the LRA, so it is not shown or calculated when the **ITU** standard is in effect.

The **EBU** defines the LRA as the range (dB in LU) between the 10th and 95th percentile points of loudness values for a program or time block after cascaded gating is applied. No target or limits are defined. Very dynamic content such as an action movie or a classical music concert may have an **LRA** value as high as 20. Most TV content will show a much lower **LRA** reading.

3. Touch **Exit** to return to the **Setup Menu** screen.

Logging

4. From the **Setup Menu** (Figure 2–18), touch **Logging** to display the **Histogram Log** (Figure 2–19 bottom).

Figure 2–18 Pandora Setup Menu

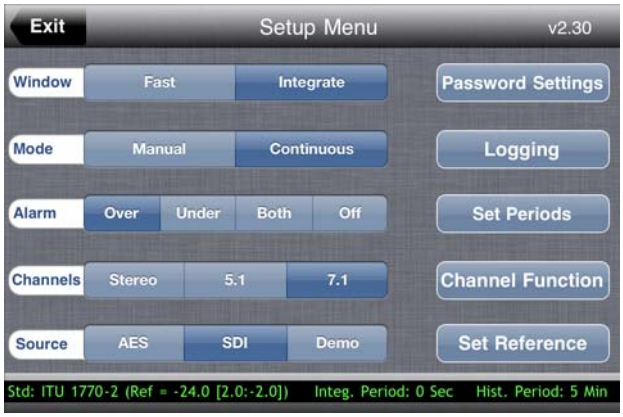
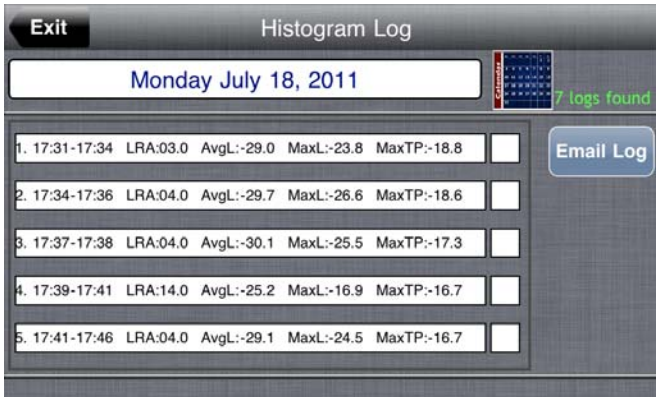


Figure 2–19 Histogram Log

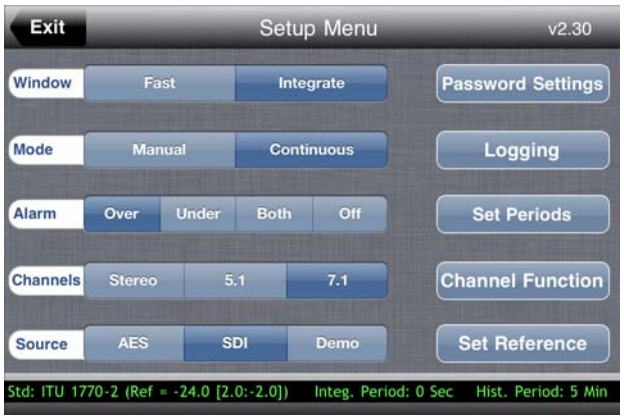


Note: For information about how to email your log file and create a graph, refer to Chapter 3: Log Data on page 35.

Password Settings

From the **Setup Menu** (Figure 2–20 below), press **Password Settings**.

Figure 2–20 Setup Menu



Note: Passwords are case-sensitive and can contain any character on the keyboard and any number of characters. The only limitation is that the password cannot be a single space.

Figure 2–21 Password Settings Menu

Creating a New Password

Creating a password for your Pandora will disallow any changes in the **Setup Menu** until you enter the correct password.

1. When the **Password Settings** screen appears (1. above) touch **Create Password**.

2. Enter and confirm passwords as indicated on the screen.

3. Touch **Exit** to return to the **Setup Menu**.

Changing an Existing Password

1. When the **Password Settings** screen appears, touch **Change Password**.

2. When the password fields appear, touch the top field and type in the existing password.

3. Enter and confirm passwords as indicated on the screen.

4. Touch **Exit** to return to the **Setup Menu**.

Removing an Existing Password

1. From the **Password Settings** menu, touch **Cancel Password**.

2. Type in the current password.

3. Once the password is confirmed, touch **Exit** to return to the **Setup Menu**.

Using a Password

1. When you have selected to use password protection, then you must enter the current password to access the **Setup Menu**.

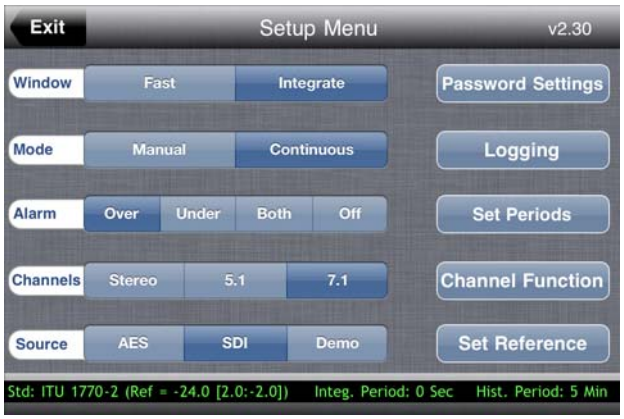
Figure 2–22 Password Settings

2. Only typing in the correct password allows access to the **Setup Menu**. In the event you forget the current password, touch **Forgot Password** and follow the instructions on the screen.

Mode

Manual mode is for production, editing and compliance checks of a specific program or interstitial piece intended for broadcast. **Continuous** mode is for compliance logging, live-to-air audio production such as local news, local sports, or musical events.

Figure 2–23 Setup Menu



- Touch **Manual** to use the main screen **Start**/**Pause**/**Stop** buttons to control the measuring period.

Note: In **Manual** mode, pressing the **Stop** button (red circle) clears the fast/momentary/short/integrated number since it is no longer needed.

- Touch **Continuous** to monitor all the time. Drag the **Integration Period** wheel to the second- or minute-duration over which you want to average the loudness of the signal. Select any value up to 60 minutes.

Window

The default standard, **ITU** vs. **EBU**, determines the loudness window choices available. For **ITU**, the choices are **Fast** (0.4 seconds) or **Integration** (1 second to 1 hour, as set in the **Setup Menu** on the **Integration Period** wheel).

For **EBU**, the choices are **Momentary** (0.4 seconds), **Short** (3 seconds) or **Integration** (1 second to 1 hour, as set in the **Setup Menu** on the **Integration Period** wheel).

Note: **ITU-Fast** and **EBU-Momentary** respond the quickest to sudden jumps in audio loudness, such as commercial breaks which are the driving force behind the loudness standards. Only the shortest windows will correctly measure relatively short audio events within a short interstitial "spot" of less than 30 seconds.

Figure 2–24 Setup Menu

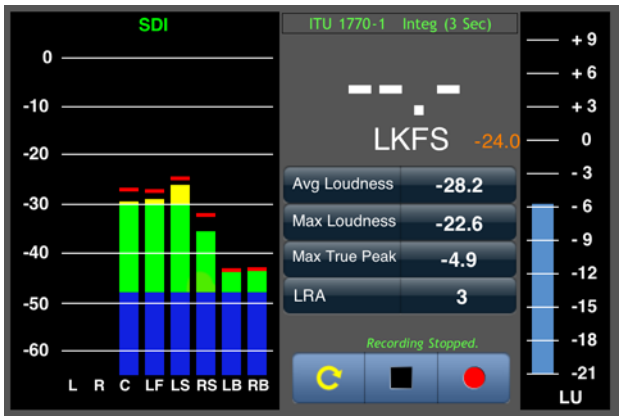
1. In the **Window** row, touch **Fast** or **Integration**.

2. Touch **Exit** to return to the last meter or histogram screen selected.

Operation

The first screen that displays after you select **W Loudness** from the application list is the **Meter Screen** as shown in Figure 2–25 below.

Figure 2–25 Meter Screen



Operational Modes

You can run Pandora in two different modes:

- Continuous Mode or
- Manual Mode.

Continuous Mode

In Continuous Mode, the Pandora continuously recalculates the loudness measurement for the time period indicated in the **Integration Period** on the **Setup Menu**. From the **Setup Menu** touch **Continuous** to display the **Meter** screen. This is the mode broadcasters would typically use.

Manual Mode

In Manual Mode, the displayed measurement will be the loudness value integrated between a manual start and stop time interval. From the **Setup Menu** touch **Manual** to be able to instantly start and stop the loudness measuring and to display the loudness meters. This is the mode producers and editors will use to measure the loudness of an individual advertisement, promotion or program.

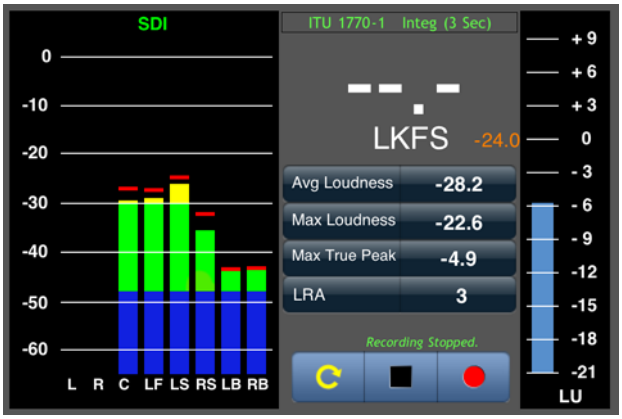
Meter Screen and Histogram Screen Controls

You can choose from three meter display screens: Level Meters, Histogram, or Numeric. Select between these screens by swiping your finger left or right over the meter display.

Note: Swipe the screen from top to bottom to display the **Setup Menu.** Avoid starting a swipe over a control so that you don't accidentally change that control.

Figures 2–26 below and 2–27 below illustrate the controls on each screen. Descriptions of these controls follow below.

Figure 2–26 Level Meter Screen (Manual Mode)



Note the LU meter scale indicator at the bottom right hand corner of the screen. Pandora has one ATSC, and two EBU scale ranges. (Zero **LU** is equal to the **Reference Level**.)

Figure 2–27 Histogram Screen - Continuous Mode

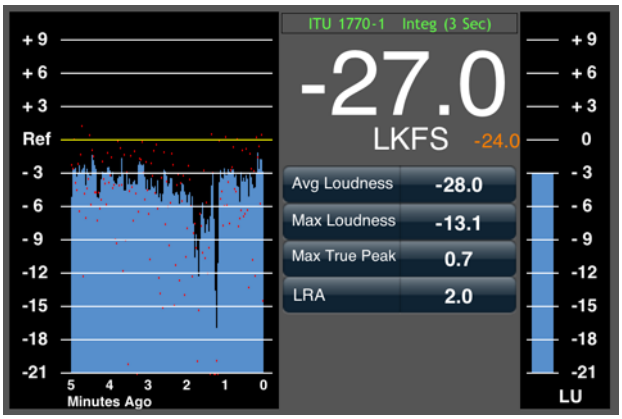
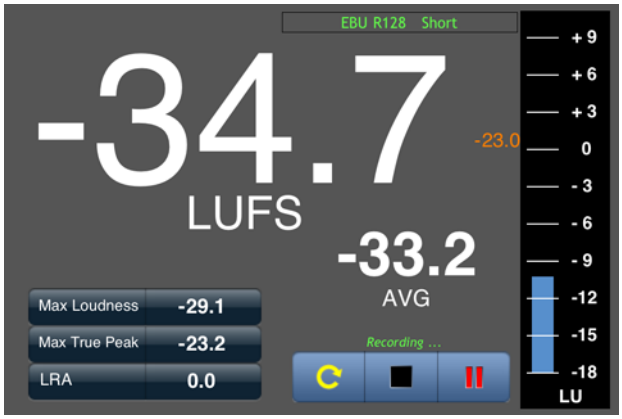


Figure 2–28 Numeric Screen - Manual Mode



- **Reset** (Yellow Circular Arrow): (Not displayed in Continuous mode) Touching **Reset** clears the histogram view.

- **Stop** (Black Square): (Not displayed in Continuous mode) Touching **Stop** ends a manual integration period.

Note: In **Manual** mode, pressing the **Stop** button (red circle) clears the fast/momentary/short/integrated number since it is no longer needed.

- **Pause** (Two Red Vertical Bars) or **Start** (Round Red Circle): This last button toggles between these two functions. **Start** begins a new loudness calculation and starts logging. Or it resumes the current record if you previously pressed **Pause**.

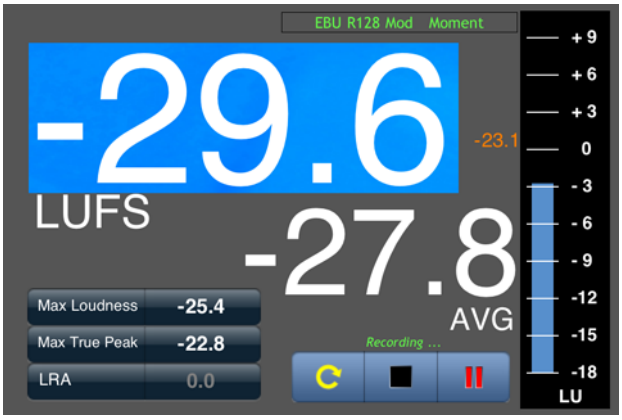
Alarm Indicators

When the loudness exceeds the **Relative Upper Limit** set in the **Reference Menu**, the screen displays *Over* on a red background as shown in Figure 2–27.

Figure 2–29 Numeric Screen - Over Limit

When the loudness falls below the **Relative Lower Limit** set in the **Reference Menu**, the screen displays *Under* on a blue background as shown in Figure 2–30 below.

Figure 2–30 Numeric Screen - Under Limit



Using the Demo Source

Select the **Demo** source to put the Pandora into **Demo** mode. You can select either **Continuous** or **Manual** mode and you do not need to have audio sources attached to the unit. **Demo** will keep the channel assignments of the last AES or SDI channel assignment selected right before you switch to **Demo**.

1. To test Pandora's features without attaching an audio source, swipe the screen from top to bottom to display the **Setup Menu**.

2. Using the **Setup Menu**, set all other settings the way you want Demo to run.

   Note: Logging does not work in **Demo** mode.

3. Return to the **Setup Menu** and touch **Demo**.

CHAPTER 3
Log Data

Introduction

Overview

This chapter describes what constitutes a record in a log, how to email the log, and how to create a graph for analysis.

Topics

About Log Data

Before we can talk about log data, we need to understand:

- How to create a new log file,
- What the *file* contains, and
- What each *record* within the file contains.

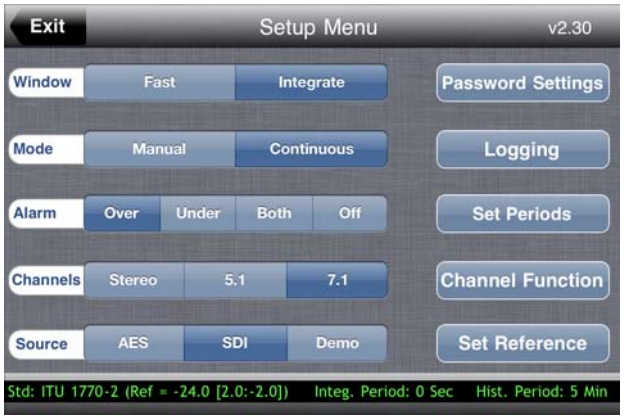
Note: When Pandora is in **Demo** mode, the system does not collect log data.

Creating New Log Files

Log files are created automatically as you measure loudness. And you can manually create a new log in **Manual** mode by pressing the **Start** button, waiting several seconds, and then pressing the **Stop** button.

For a description of each mode, refer to Mode on page 28. The **Setup Menu** (Figure 3–1 below) is provided here for reference.

Figure 3–1 Setup Menu



Manual Mode

In **Manual** mode, the system will begin a new log file every time you press the **Start** button and end the log every time you press the **Stop** button. In **Manual** mode, the system can log for a maximum of eight hours. If it has been eight hours since the **Start** button was pressed, the current log ends and a new log begins.

Pressing the **Pause** button stops the data log collection but does not begin a new file. Log data collection resumes when you press the **Start** button. Also, if a log file is in process, pressing the **Start** button also stops the existing log file.

Continuous Mode

In **Continuous** mode, Pandora will begin a new file every night at midnight based on the iPod's internal clock.

Both Modes

In both **Manual** and **Continuous** modes, while logging is in progress, if one of the following settings is altered, a new file will begin (i.e. a new log file will be created and records will be logged).

Note: Logging must be in progress for the following changes to start a new log file.

- **Mode**: Changing from **Manual** to **Continuous** or vice versa.
- **Window**: Changing from one type of **Window** to another

  Note: Refer to Window on page 28 for details.

  Windows for **EBU**:
  - **Moment**
  - **Short**
  - **Integ**

  Windows for **ITU**:
  - **Fast**
  - **Integ**
- **Integration Periods**: Changing the **Integration Period** while the **Integration and Histogram Periods, and LRA Window** is selected.

  Note: Pressing the yellow circular arrow at the bottom of the histogram view does not create a new log record. It only clears the histogram screen.

  Refer to Set Periods on page 22 for details.
- **LRA** (loudness range) **Window**: Changing the **LRA Window** setting in the **Periods** screen

- **Reference**: Changing between standards (i.e. **ITU** to E**BU**, or vice versa) or changing the **Reference Level**, **Relative Upper Limit**, or **Relative Lower Limit**. (Refer to Set Reference on page 15 for more information.)

On the other hand, the following setting changes will *not* cause a new log to be started:

- **Alarm**
- **Channels**
- **Source**
- **Password**

Log File Contents

Pandora generates a .csv file that you can open in Microsoft® Excel. Within the file is one worksheet that contains header data and the sample records.

Header Data

The header of the log file includes:

1. **Start Date**
   - **Continuous**: The date the loudness sampling began
   - **Manual**: The date you pressed the **Start** button
2. **Start Time**
   - **Continuous**: The time the loudness sampling began
   - **Manual**: The time you pressed the **Start** button
3. **End Date**
   - **Continuous**: The date the loudness sampling ended
   - **Manual**: The date you pressed the **Stop** button
4. **End Time**
   - **Continuous**: The time the loudness sampling ended
   - **Manual**: The time you pressed the **Stop** button

5. **File Name**: The name of this log file

6. **Sample Increment** (non-configurable):
   - **Continuous**: 0.5 seconds
   - **Manual**: 0.2 seconds

7. **Reference Level (LKFS)**: The value of the **Reference Level** setting while the samples were being collected

8. **Upper LU Limit**: The upper reference limit above which all loudness values were flagged with an **Over** alarm if alarming for **Over** values is enabled.

9. **Lower LU Limit**: The lower reference limit below which all loudness values were flagged with an **Under** alarm if alarming for **Under** values is enabled.

10. **Standard**: either **ITU** or **EBU**

11. **Window**: When Standard is set to ITU, then the Window can be either **Fast** or **Integ**. When the Standard is EBU, then the Window can be **Moment**, **Short**, or **Integ**. (Refer to Window on page 28 for details.)

12. **Integration Period (Sec)**: The selected **Integration Period** measured in seconds.

13. **Loudness Range (LRA)**: The numeric value, in dB, calculated per EBU R128 Tech 3342.

14. **Maximum Level (LKFS)**: The loudest value in the file.

15. **Average Level (LKFS)**: The average loudness of all loudness values in the file.

16. **Maximum True Peak**: The highest absolute true peak value from any metered channel in the record

Record Data

Each data record includes:

- **Column A**: The difference between the loudness value and the loudness target measured in dB (decibels).

- **Column B**: The true peak value of this loudness sample measured in dB. The true peak is the highest true peak value, in dBFS, among all metered channels for the sample period.

- **Column C**: When running in Continuous mode, the logs measure the LRA at the rate of the **LRA Window** selected.

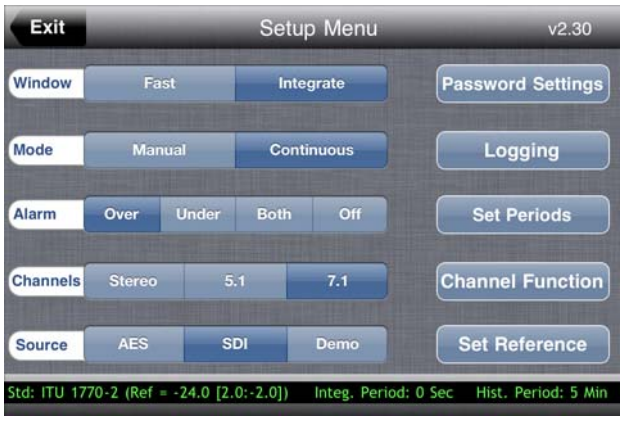
Emailing the Log File

The following instructions will have you creating a short log file for emailing via WiFi to a networked computer where the file data can be displayed and further analyzed. A local WiFi network must be present and any security passwords entered before proceeding.

Note: Before emailing the first time, the iPod will ask you to set up your account information for the email service you select. Setups for public services like Yahoo!® are self-explanatory when you have an existing account there. Consult your firm's IT department for assistance in setting up the system to receive emails through your company network and email server.

Pandora log files are in .csv format, viewable by text editor and spreadsheet applications. A text editor is all that is needed to display the summary data, (i.e., the extended sample data may be discarded to reduce file size if unneeded). Any spreadsheet can be used to further analyze the log file data-- a Microsoft Excel® template is available for download at the **Pandora Downloads** page on www.wohler.com to display data graphically and determine pass/fail outcomes based on the set limits. See Creating a Line Graph on page 46 for details.

Figure 3–2 Setup Menu

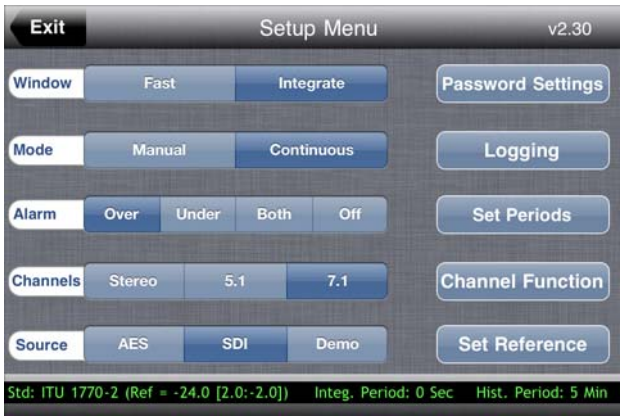


1. From the **Setup Menu**, touch **Logging**. The **Logging** menu displays today's date and the number of logs found for the day (Figure 3–3 below). In the example below July 16th no logs are available.

Figure 3–3 Histogram Log

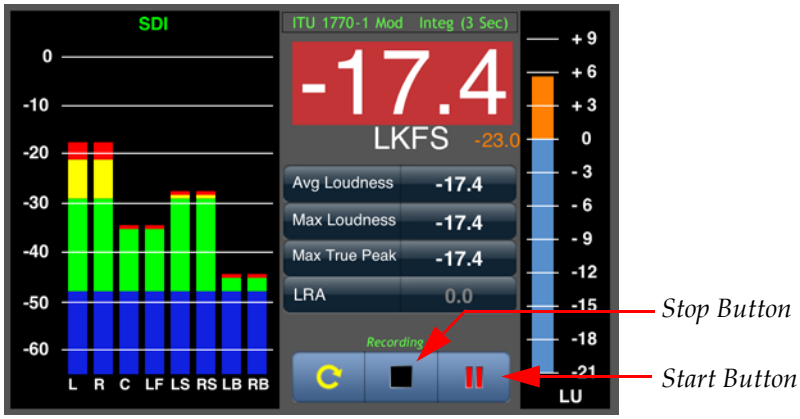
2. To create a sample log file, press **Exit** to return to the **Setup Menu**.

Figure 3–4 Setup Menu



3. From the **Setup Menu**, touch **Manual** in the **Mode** row to display the meter screen.

Figure 3–5 Meter Screen - Manual Mode

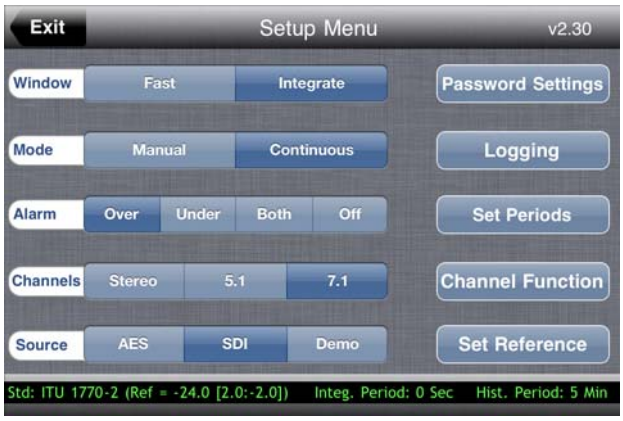


4. Press the **Start** button and wait for several seconds.

5. Press the **Stop** button to end the log file.

6. Swipe the screen from top to bottom to redisplay the **Setup Menu.**

Figure 3–6 Setup Menu



7. Now, touch **Logging**. You should see a record for today's date with the current time.

8. For our example, however, we'll use an alternate date. To change the date, touch the calendar icon (Figure 3–7 below).

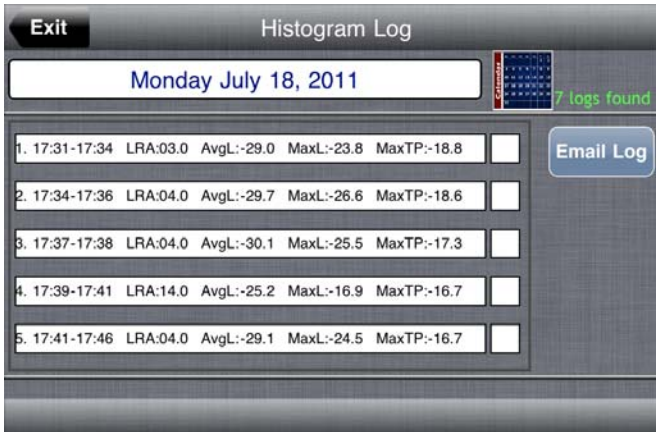
9. Swipe the rollers to select the date for which you want to email log data.

Figure 3–7 Histogram Log Screen

10. When the desired date is displayed, touch the calendar icon again to hide the calendar.

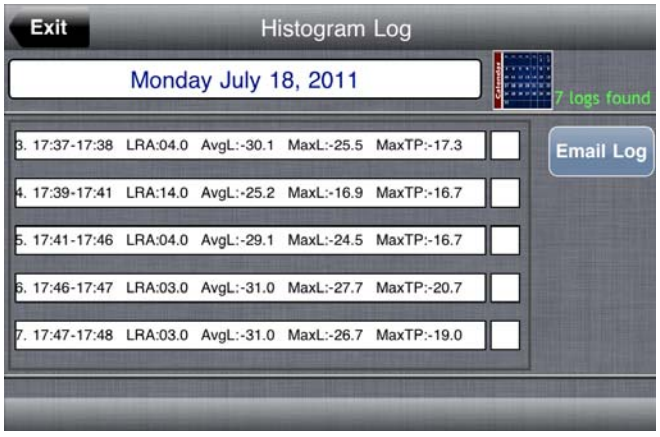
The description of the log files found will appear in the scrollable window (Figure 3–8 below). For example, several logs are listed for July 18th, and the first five are shown in the window.

Figure 3–8 Histogram Log Screen



11. To see the rest of the log files selected above, swipe the screen from bottom to top to scroll the window upward (Figure 3–9 below). Note that now Logs 3 to 7 are shown in the same window.

Figure 3–9 Histogram Log Screen



12. To email a log or multiple logs touch the checkbox next to the desired log, then touch the **Email Log** button.

Figure 3–10 Histogram Log Screen with Selected Log Files

13. Apple's email application will open (Figure 3–11 below). The subject and body of the email will be filled out by Pandora and the selected (checked) log files will be attached.

Figure 3–11 Histogram Log Screen with Selected Log Files

14. Touch the **To:** field (Figure 3–12 below) and type the email address of your recipient.

Figure 3–12 Pandora Email Screen

15. When the email address is correct and complete, touch the **Send** button (top right corner) to email the log file(s).

    After the email message closes, the iPod will display **Email Sent** in the status bar and return to the Pandora application.

Creating a Line Graph

For your convenience, Wohler has created a graphics template (using Microsoft Excel) that can accept the .csv data into the **Raw Data** worksheet and automatically update a graph based on the data you copied. Note that this template is only intended to be a starting point for your data analysis. To download and use the Excel template, follow the instructions below.

Downloading the File

1. Power up your PC or laptop and launch the web browser.

2. Create a folder on your desktop called **Pandora Graph Maker**.

3. Navigate to the wohler web site: www.wohler.com.

Decision Point:

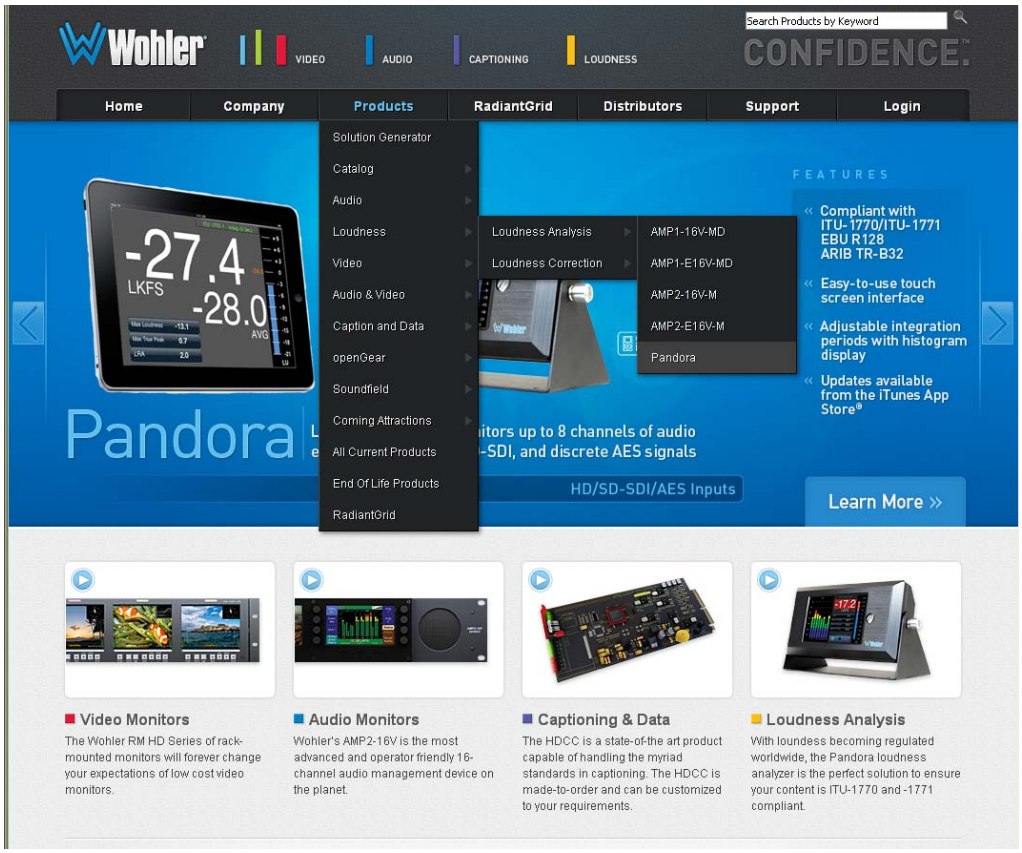
If you already have a member user ID and password for the Wohler web site, then log in by clicking on the Member Sign In link at the top right hand corner of the home page and sign in.

Otherwise, if you do *not* already have a member user ID and password then you must click Register as New User at the top right hand corner of the home page, and enter the requested data. Remember to log in after you have created your account.

Registration is free and we will not transfer your information to third parties. We will only use the information to provide better service to you.

4. Once you have successfully logged into the Wohler web site, click **Products** from the home page menu bar to navigate to the Pandora product page.
   A. Move the cursor down the menu to highlight **Audio.**
   B. Then move the cursor to the sub-menu to highlight **Loudness Analysis**.
   C. Finally, move the cursor to the third menu to click on **Pandora**. (See Figure 3–13 on page 48.)

Figure 3–13 Selecting Pandora



5. When Pandora's page displays, click on the **Downloads** tab in the middle of the page.

6. double-click **Pandora Graph Maker (ZIP)** to begin the download.

   Note: If you are taken to a log in page, that means you are not logged in.

7. When the **File Download** dialog appears, click **Save**.

8. When the **Save As** dialog appears, navigate to the folder you created in Step 2 on page 46 and click **Save**.

9. After the download is complete, right click on the .zip file, and choose **Extract All**.

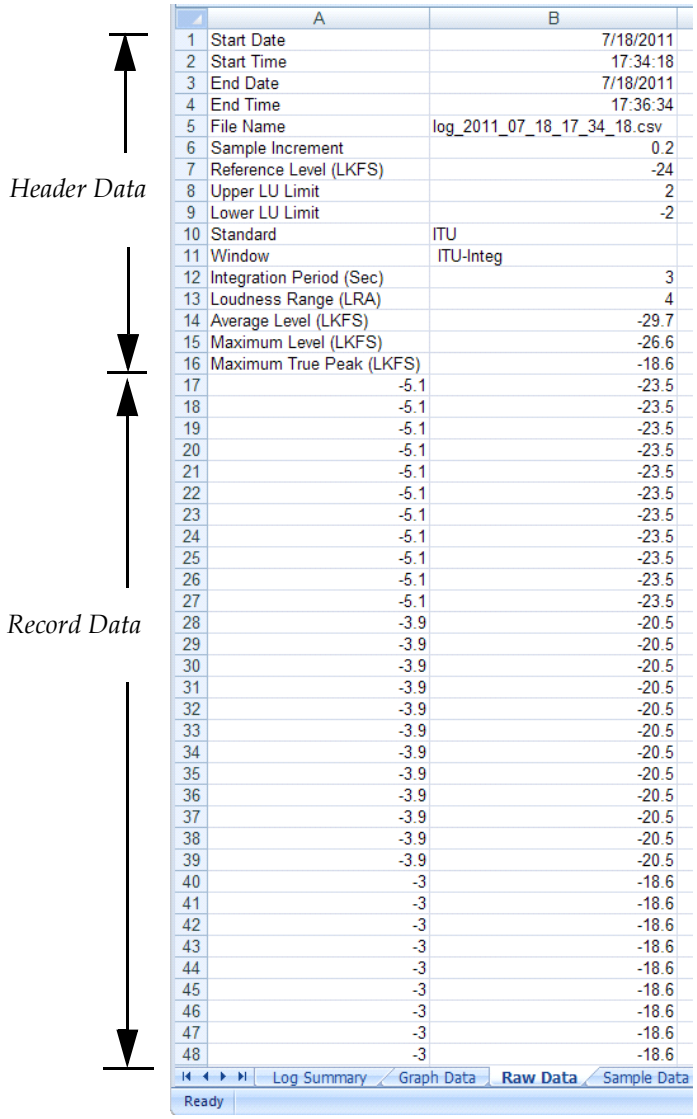
Creating the Graph

To view your data in graphic form, follow the instructions below.

1. First open the **Pandora Graph Maker** file you just downloaded.

2. Open the Pandora log file you received in your email inbox.

Figure 3–14 Abbreviated Sample .csv File



	A	B
1	Start Date	7/18/2011
2	Start Time	17:34:18
3	End Date	7/18/2011
4	End Time	17:36:34
5	File Name	log_2011_07_18_17_34_18.csv
6	Sample Increment	0.2
7	Reference Level (LKFS)	-24
8	Upper LU Limit	2
9	Lower LU Limit	-2
10	Standard	ITU
11	Window	ITU-Integ
12	Integration Period (Sec)	3
13	Loudness Range (LRA)	4
14	Average Level (LKFS)	-29.7
15	Maximum Level (LKFS)	-26.6
16	Maximum True Peak (LKFS)	-18.6
17	-5.1	-23.5
18	-5.1	-23.5
19	-5.1	-23.5
20	-5.1	-23.5
21	-5.1	-23.5
22	-5.1	-23.5
23	-5.1	-23.5
24	-5.1	-23.5
25	-5.1	-23.5
26	-5.1	-23.5
27	-5.1	-23.5
28	-3.9	-20.5
29	-3.9	-20.5
30	-3.9	-20.5
31	-3.9	-20.5
32	-3.9	-20.5
33	-3.9	-20.5
34	-3.9	-20.5
35	-3.9	-20.5
36	-3.9	-20.5
37	-3.9	-20.5
38	-3.9	-20.5
39	-3.9	-20.5
40	-3	-18.6
41	-3	-18.6
42	-3	-18.6
43	-3	-18.6
44	-3	-18.6
45	-3	-18.6
46	-3	-18.6
47	-3	-18.6
48	-3	-18.6

Log Summary | Graph Data | Raw Data | Sample Data

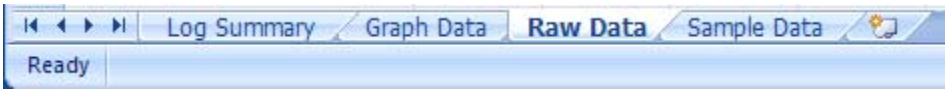
Ready

3. In the log file you received (in your email inbox) copy the two data columns. That is, click and drag over columns A and B (over their column head labels) so that both columns are highlighted.

4. Hold down the **[Ctrl]** key and press **C** to copy the columns.

5. Now return to the **Pandora Graph Maker** file. Click on the third worksheet at the bottom of the application window called **Raw Data** (Figure 3–15 below).

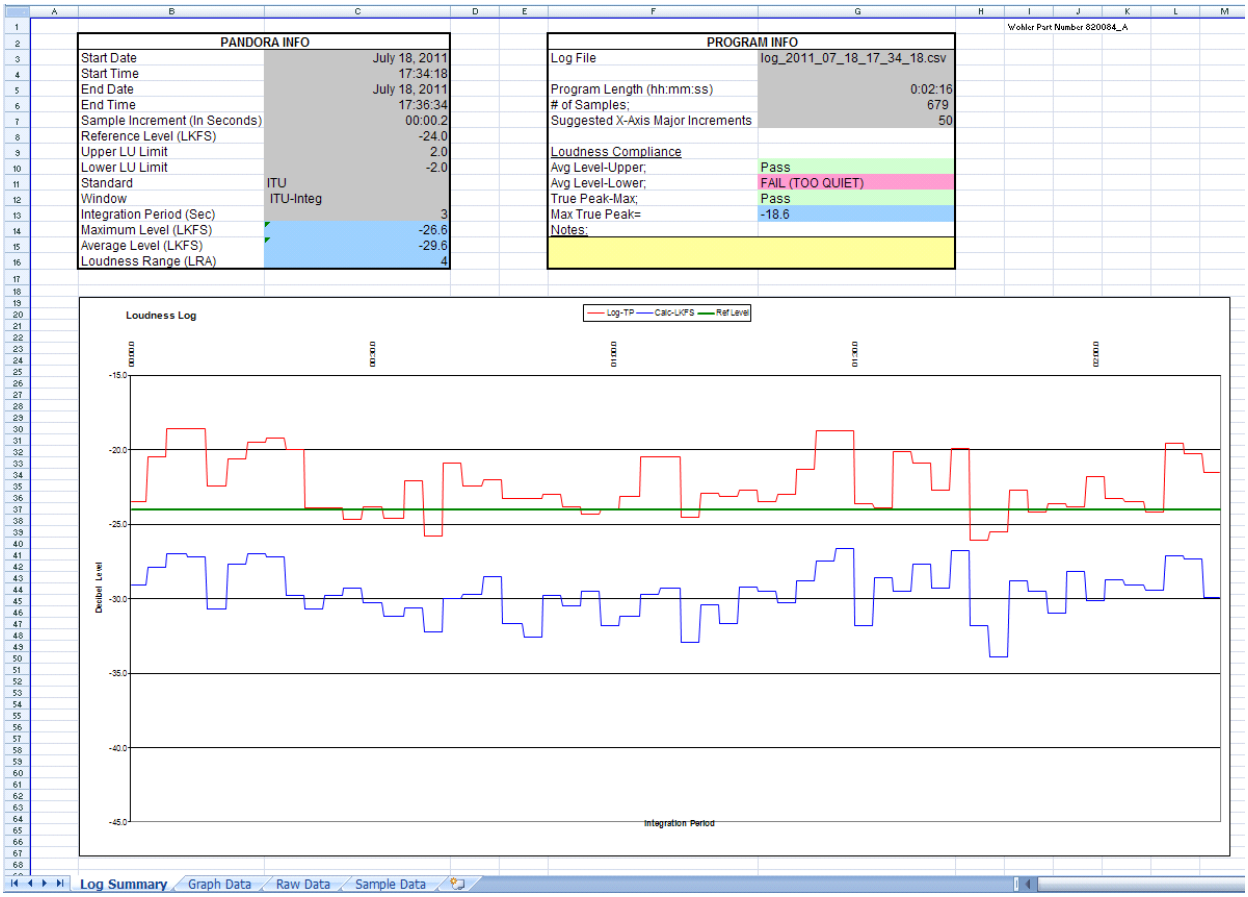
Figure 3–15 Raw Data Worksheet



6. To paste the columns you copied into columns A and B of this worksheet, hold down the **[Ctrl]** key and press **V**.

7. Now click on the first worksheet (bottom of the window) **Log Summary**, to display the graph.

Figure 3–16 Pandora Sample Log Data in Graphic Format - Log Summary Worksheet



This spreadsheet is only intended to give you a start on graphing your data. You can modify it any number of ways to suit your needs.

If you substantially improve this template and you'd like us to make it available to others, please email it to support@wohler.com and we will evaluate it.

CHAPTER 4
Features and Specifications

Introduction

Overview

This chapter details the features and specifications of Pandora.

Topics

Features

- AES and SDI inputs
- 9V power supply operates over mains voltage ranging from 100V to 240V ± 10%, 50Hz or 60Hz, meeting all relevant safety and emissions requirements.
- The intuitive touch-screen configuration interface allows for quick adjustments on the fly.
- The front panel display is used for both operator interface and upper and lower limit alarm indications.
- LU measurements in addition to LKFS (ATSC) or LUFS (EBU measurements are provided simultaneously.
- The loudness and true peak measuring algorithms comply with ITU-R BS1770-1, ITU-R BS1770-2, and EBU R-128.
- Automatic threshold gating function complies with the latest loudness standards for mistake-proof measurements.
- The loudness display is a prominent, three-digit numerical readout. The unit of measurement is LKFS as defined by the ITU recommendation or LUFS as defined by the EBU recommendation.
- Pandora measures up to 8 channels of PCM digital audio signals, from AES inputs or de-embedded from SDI, easily switched between common 2.0, 5.1 and 7.1 program sets or a custom meter configuration.
- Average loudness value indicated at the end of each integration period.
- Wide range of integration periods suitable for measurement time blocks from seconds to a day.

Specifications

The specifications for the Pandora are listed in Table 4–1 below.

Table 4–1 Specifications for the Pandora

Specification	Value
Power	100 V to 240 V ± 10%, 50Hz or 60Hz
Loudness and True Peak Compliance	ITU-R BS.1770-1, BS.1770-2, BS.1771, BS.1864, referenced by ATSC A/85 and ARIB TR-B32 EBU R128
Modes	Manual and Continuous
Channels	Up to 8
Input Signal Types	4 AES, 75Ω (BNC) 1 SDI, 75Ω (BNC)
SD-SDI	270 Mb/s: SMPTE 259M / 480i59.94 (NTSC); ITU-R BT.656 / 525i50 (PAL)
HD-SDI	1.485 Gb/s: SMPTE 292M; 720p60, 720p59.94, 720p50, 720p30, 720p25, 720p24, 1080i50, 1080i59.94, 1080i60
3G-SDI	2.970 Gb/s: SMPTE 425M-A (Single Link) 1080p50, 1080p59.94

APPENDIX A
Glossary

AC-3 — Digital Audio Compression Standard (AC-3, E-AC-3), as described in ATSC A/52B.

Anchor Element — The perceptual loudness reference point or element around which other elements are balanced in producing the final mix of the content, or that a reasonable viewer would focus on when setting the volume control.

ARIB — Association of Radio Industries and Businesses. ARIB TR-B32 abides by ITU BS.1770 and BS.1864 for its audio loudness standards used mainly in Japan. Significant loudness measurement theory is included.

ATSC — Advanced Television Systems Committee. ATSC A/85 abides by ITU BS.1770 and BS.1864 for its audio loudness standards used mainly in North America. Significant loudness measurement theory, AC-3 metadata dialnorm concepts and monitoring applications information is included.

BS.1770 — ITU-R BS.1770. ITU BS.1770-1 has no gating, where ITU BS.1770-2 has -70 LKFS absolute and -10 LU relative gating, same as EBU R128 as of Aug 2011. Loudness meters and measurement tools which have implemented the BS.1770 algorithm will report loudness in units of LKFS.

Content — Material or essence used for distribution by an operator.

dB — Decibel

dB FS — Decibels, relative to full scale sine wave (per AES17)

dB TP — Decibels, true-peak relative to full-scale (per ITU-R BS.1770 Annex 2)

Dialnorm — An AC-3 metadata parameter, numerically equal to the absolute value of the Dialog Level, carried in the AC-3 bit stream. This unsigned 5-bit code indicates how far the average Dialog Level is below 0 LKFS. Valid values are 1 - 31. The value of 0 is reserved. The values of 1 to 31 are interpreted as -1 to -31. The decoder applies an amount of

gain reduction equal to the difference between -31 and the dialnorm value.

Dialog Level — The loudness, in LKFS units, of the Anchor Element.

EBU — European Broadcasting Union

ITU — International Telecommunication Union

LKFS — Loudness, K-weighted, relative to full scale, measured with equipment that implements the algorithm specified by ITU-R BS.1770. A unit of LKFS is equivalent to a decibel.

LU — Loudness Unit, relative to the Reference Level.

LUFS — Loudness units, relative to full scale, measured with equipment that implements the algorithm specified by EBU R128. A unit of LUFS is equivalent to a decibel.

Long form content — Show or program related material or essence. The typical duration is greater than approximately two to three minutes.

Loudness — A perceptual quantity; the magnitude of the physiological effect produced when a sound stimulates the ear.

Loudness Range — The range (dB in LU) between the 10th and 95th percentile points of loudness values for a program or time block after cascaded gating is applied.

LRA — Loudness Range

Measured loudness — The magnitude of an audio signal when measured with equipment that implements the algorithm specified by ITU-R BS.1770. It is an approximation of perceived loudness.

PPM — Peak program meter

R128 — Loudness recommendation EBU R128. It, with companion Tech 3341 through 3344 specifications and guidelines, tells how broadcasters can measure and normalise audio using Loudness meters instead of Peak Meters. Loudness meters and measurement tools which have implemented the R128 algorithm will report loudness in units of LUFS.

Reference Level — Target Loudness Level, a value specified for uniform perceived loudness. ITU-R BS.1864 (and ATSC A/85 & ARIB TR-B32 by reference) specifies -24 LKFS. EBU R128 specifies -23 LUFS.

Relative Upper Limit — Deviations from Reference Level allowed, in dB. ITU limits are +/- 2 LU. EBU limits are ± 1 LU.

Relative Lower Limit — Deviations from Reference Level allowed, in dB. ITU limits are +/- 2 LU. EBU limits are ± 1 LU.

Short form content — Advertising, commercial, promotional or public service related material or essence. Also termed "interstitial" content. The typical duration is less than approximately two to three minutes.

Target Loudness — A specified value for the Anchor Element (i.e., Dialog Level), established to facilitate content exchange from a supplier to an operator.

True peak — The maximum absolute level of the signal waveform in the continuous time domain, measured per ITU-R BS.1770 Annex 2.

VU — Volume unit

APPENDIX B
References

The following standards, current as of this publication, are the basis for Pandora ITU and EBU default measurement settings. Additional information concerning standards development, their theoretical and subjective bases, and suggested application can be found at the standard's body web site for download.

Web site for ITU Broadcast Standards:
http://www.itu.int/rec/R-REC-BS/e

ITU BS.1770-2, March 2011: Algorithms to measure audio programme loudness and true-peak audio level.
http://www.itu.int/rec/R-REC-BS.1770-2-201103-I/en

ITU BS.1771, July 2006 : Requirements for loudness and true-peak indicating meters.
http://www.itu.int/rec/R-REC-BS.1771-0-200607-I/en

ITU BS.1864, March 2010: Operational practices for loudness in the international exchange of digital television programmes.
http://www.itu.int/rec/R-REC-BS.1864-0-201003-I/en

Web site for EBU Technical / Loudness:
https://tech.ebu.ch/webdav/site/tech/shared/testmaterial/ebu-r-128-logo.zip

EBU Recommendation 128, August 2010: Loudness Normalisation and Permitted Maximum Level of Audio Signals.
https://tech.ebu.ch/docs/r/r128.pdf

EBU Tech 3341: Loudness Metering.
https://tech.ebu.ch/webdav/site/tech/shared/tech/tech3341.pdf

EBU Tech 3342: Loudness range Descriptor.
https://tech.ebu.ch/webdav/site/tech/shared/tech/tech3342.pdf

EBU Tech 3343: Production Guidelines.
https://tech.ebu.ch/webdav/site/tech/shared/tech/tech3343.pdf

EBU Tech 3344: Distribution Guidelines.
https://tech.ebu.ch/webdav/site/tech/shared/tech/tech3344.pdf

Web site for ATSC Recommended Practices:
http://www.atsc.org/cms/index.php/standards/recommended-practices?layout=default

ATSC Doc. A/85, November 2009: ATSC Recommended Practice: Establishing and Maintaining Audio Loudness for Digital Television.
http://www.atsc.org/cms/index.php/standards/recommended-practices/185-a85-techniques-for-establishing-and-maintaining-audio-loudness-for-digital-television

Commercial Advertisement Loudness Mitigation (CALM) Act, Pub. L. 111-311, 47 United States Code § 621 (2011).