Sonic Nuance
ELECTRONICS

Hear Everything, Always

TDI User Manual v3.0
January 2020

Introduction

Hello,

My name is Ted and I have designed, assembled, tested and hand signed your TDI (tuner + DI). I thank you for your purchase and welcome you to the Sonic Nuance Electronics family - people like you who crave to hear every thing, always!

The TDI integrates a chromatic tuner with a DI and transparent 1/4" buffer. It has a quiet mute feature as well as 48V XLR or DC-jack powering and super bright LEDs. Audiophile-grade quality components are used (including costly wide dynamic range, low noise op amps, low distortion mechanical relays, film capacitors and tightly matched resistors) for the all analog signal path to provide uncompromising sound quality over a wide dynamic range for years to come.

While the TDI is simple to use, reading this manual will help you get the most out of it and help answer common questions. However, don't hesitate to contact me should you have any questions or suggestions at sonicnuance.com.

History

I started Sonic Nuance Electronics in 2012 with the original TDI, thus it has a special place in my heart.

After years of playing live gigs as an amateur bassist and acoustic guitarist, my dream was to minimize the gear I needed to bring while still having pristine and reliable sound. The idea was to combine the only pieces of equipment I consistently needed (a tuner, a DI and a patch cable connecting them), and removing the need for a separate power source like a battery or DC adapter. Being part of a portable church's worship team that set up and tore down equipment multiple times a week, I learned quickly what was needed as well as what lasted and what didn't. I have been using the TDI to this day, usually in a minimalist setup as shown in Figure 1. Soundmen love it for the sound, simplicity and no need for a battery. Stage and lighting designers love it because it is so small.

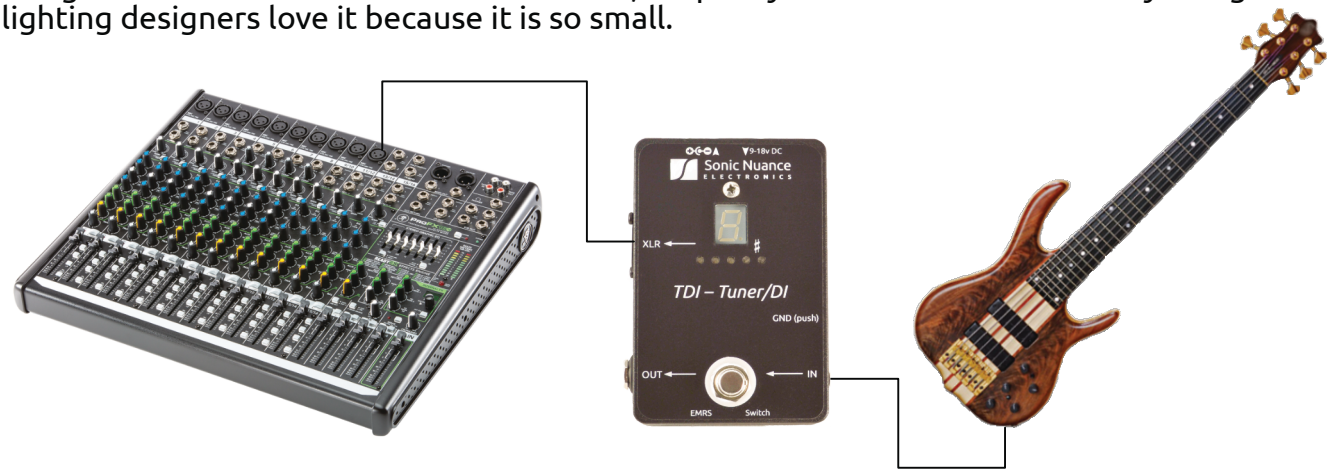

Figure 1: Minimalist setup with mixing board powering the TDI.

Front Panel

Figure 2 shows the TDI's front panel, please take a moment to familiarize yourself with it.

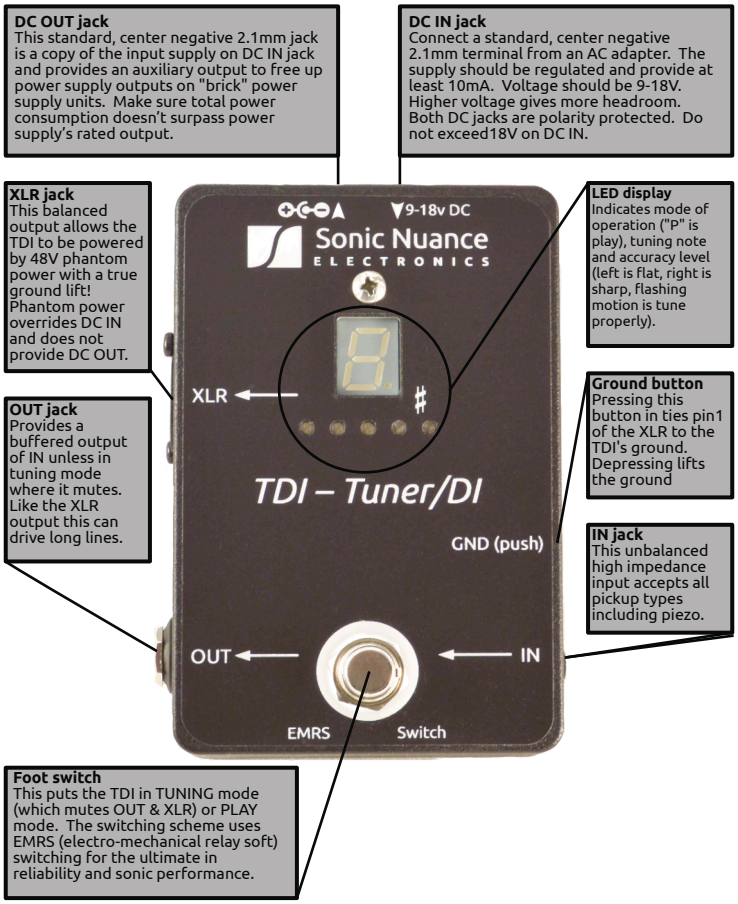

Figure 2: TDI Front Panel

Additional Notes on Front Panel

DC IN Jack: This jack is polarity and over-voltage protected. Use a center negative dc supply (not included) with 9 to 18V voltage (18V is preferred as it gives additional headroom to the signal path which further reduces unwanted distortion). The TDI uses very little current (less than 10mA) so a standard 100mA power source will be plenty. If the TDI is XLR powered, this jack does not function.

DC OUT Jack: This output is polarity protected so if you accidentally were to plug a power supply here it won't damage the SBS under normal circumstances. This will be a copy of the voltage provided on the DC IN jack. Make sure the power supply tied to DC IN has a current capacity high enough to drive the TDI plus whatever is tied to DC OUT (maximum 300mA out of DC OUT which is fuse protected).

IN Jack: If no input is provided, both 1/4" OUT and XLR are automatically muted. The input impedance is typically 2Meg ohms.

XLR Jack: If powering the TDI via phantom power, make sure to provide 48V (P48) on this jack. Lower voltages will not be able to power the unit consistently. The DC in and DC out jacks are automatically disabled when XLR powering. Make sure to mute the channel the XLR will be plugged into as the sudden current drain on the line will cause a loud "pop" just

Additional Notes on Front Panel (Continued)

Foot switch: This will respond to toggling about once every three seconds. Faster toggle rates will be filtered out and ignored.

GND (push) switch: Unlike other products, the TDI uses a patented design allowing it to be powered via the XLR jack even when the ground is lifted.

OUT jack: This is a buffered and transformer isolated copy of the signal on the IN Jack. It is designed to provide superior performance to so called "true bypass" designs. This can drive 200 feet of cable with ease, and with transformer isolation, it helps remove the hum caused by ground loops.

Powering the Unit

To avoid the transient audio "pop" when powering up or down the TDI, follow this rule: *make sure that what the TDI's XLR and 1/4" OUT jacks are connected to are muted or off first.*

For example, before powering on or off the TDI when connected to the input of an amplifier, make sure the amp is muted or off first. This way the turn on or off transient "pop" of the TDI (or any other equipment it is connected to for that matter) will be muted. Similarly, if the TDI is to be powered via the XLR plug, make sure the channel the XLR is connected to on the mixer is muted before connecting/disconnecting the XLR plug.

After powering up the TDI, it is recommended to wait 2-3 minutes before using the foot switch. Due to the high input impedance of the buffers, it takes some time to allow internal voltages to stabilize and make the switching as audibly quiet as possible.

Modes of Operation

The TDI can be in one of two modes: TUNING and PLAY modes. In TUNING mode, the display shows the current note detected on the input jack (or "C" if nothing is detected as the tuning algorithm is cleared when first put in this mode or on power up. Once a note is detected, the display will change accordingly and remain until another note is detected or the mode is changed). Upon power up, the TDI will start in tuning mode for most situations.

In PLAY mode, the display indicates the letter "P". The internal digital clock is slowed to a minimum to avoid digital "hash" corrupting the analog signal. Getting rid of this hash is especially important when using high gain amplifiers. Also, unlike the competition, the signal does not pass through a transistor switch which can cause unwanted distortion.

Tuning with the TDI

To engage the tuner, make sure the display does NOT show the letter "P". When the tuner is activated, both XLR and 1/4" OUT outputs are muted for silent tuning. (Note that this could also be used to change instruments without bothering the soundman in live situations.)

Pluck a *single* note at a time (you should mute the strings not being tuned) and the display window will indicate the note that is being played. A dot in the lower right corner of the display indicates the sharp (#) of the note. The display indicates the chromatic notes detected in "mute mode" as shown in the table below:

Note	A	A#	B	C	C#	D	D#	E	F	F#	G	G#
Display	A	A.	b	C	C.	d	d.	E	F	F.	G	G.

Tune your string up or down until the center "in tune" LED is displayed or a sequence of outer LEDs go toward it in a flashing pattern indicating proper tuning stability is achieved. Figure 3 shows the mapping between the LED tuning accuracy display and the level of tuning.

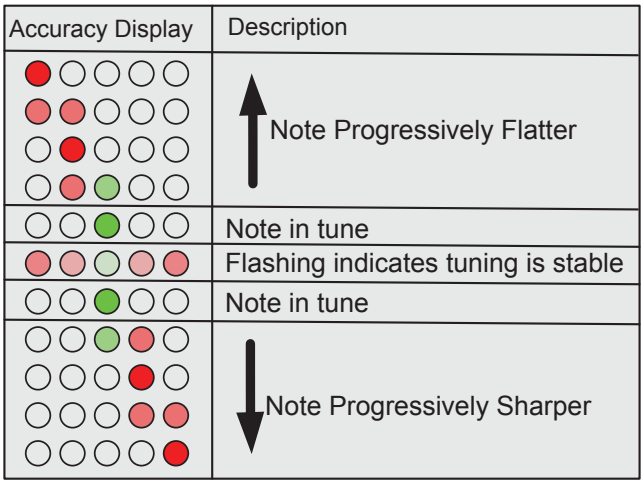

Figure 3: Accuracy Display

The TDI's chromatic tuner is quite sensitive (at least +/- 1 cent) and has a large dynamic range. You may find that plucking a string lightly with the volume knob at maximum gives faster and/or more stable note detection. This is due to the fact that most instrument strings pull sharp by up to 10 cents depending on how hard they are plucked and introduce more overtones. Rather than completely eliminating this information, the TDI shows some of it allowing the user to see the effect of attack and overtones on pitch. The harder the string is plucked, the more sharp the initial attack will be and the more overtones there will be. For this reason, either plucking the string lightly or waiting for the string amplitude to decay may give more stable results.

If tuning is still difficult, try one or more of the following:

1) tune using the 12th fret harmonic on a guitar/bass

2) pluck closer to the neck or use the tone knob to get fewer overtones

3) use the neck pickup vs the bridge pickup on multi pickup instruments to get fewer overtones

4) tune going from flat to sharp while slowly turning the instrument's tuning machine

5) dampen all strings but the one you are focusing on

6) tune an acoustic-electric instrument when the soundboard isn't vibrating due to other band instruments playing (i.e. drums, loud bass, etc)

Due to the accuracy of the TDI, you may also notice the following:

1) tuning while sitting with your instrument gives a different result than when standing (since the torque on the neck is slightly different between sitting and standing).

2) as a note decays it may not stay at the same tuning level. This depends on many factors regarding stability of the instrument's saddles, neck and body.

Usage Models

The TDI can be used in a variety of settings. This section shows some of them.

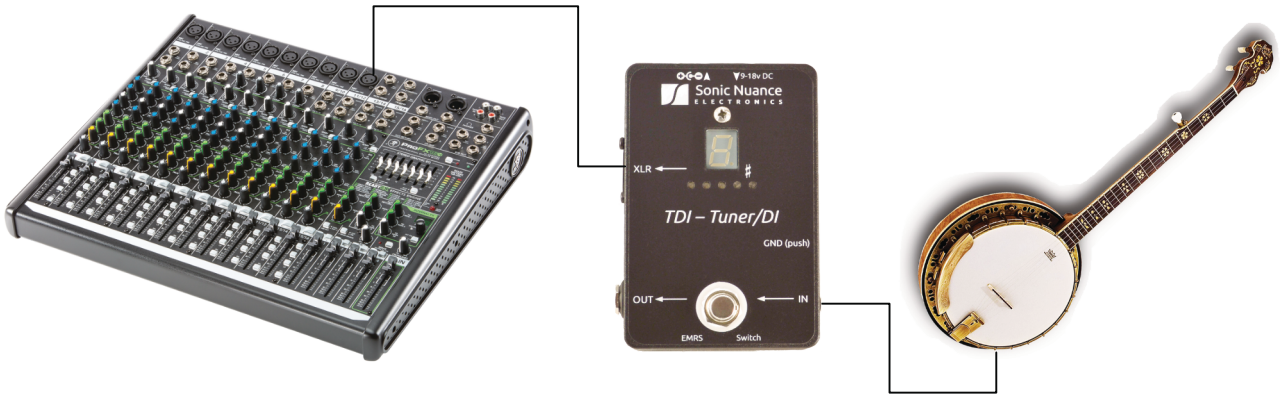

Figure 4: Piezo equipped banjo direct into the TDI.
Mixing board powering the TDI via 48V on XLR cable.

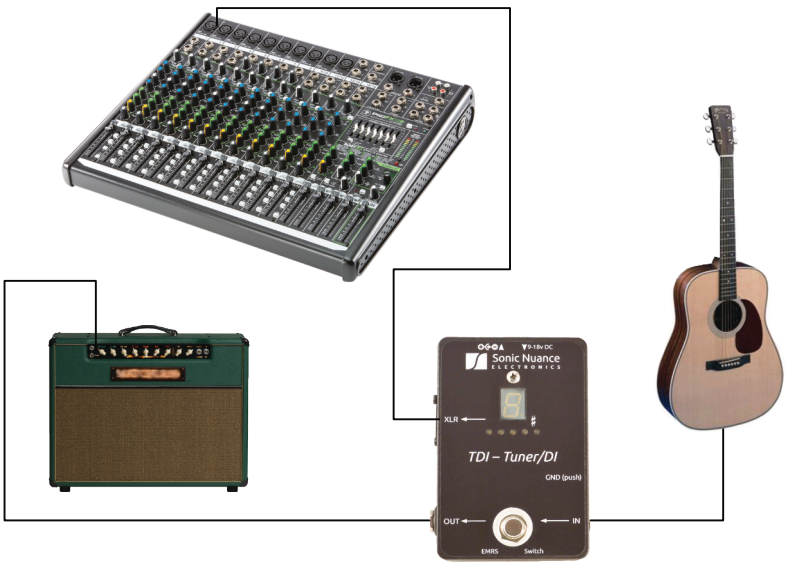

Figure 5: TDI Powered via 48V on XLR cable simultaneously driving an amp. Outputs are ground isolated.

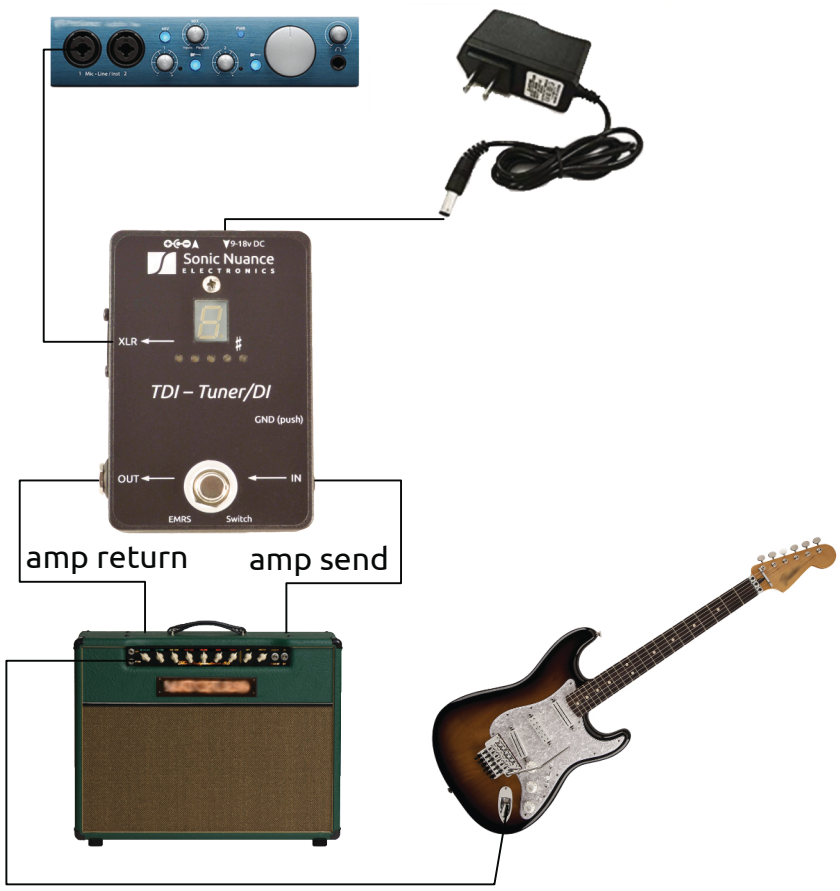

Figure 6: TDI used in amplifier's effects loop while powered with DC adapter. XLR signal has amplifier's tone while being ground isolated. Both amp and XLR are muted during tuning.

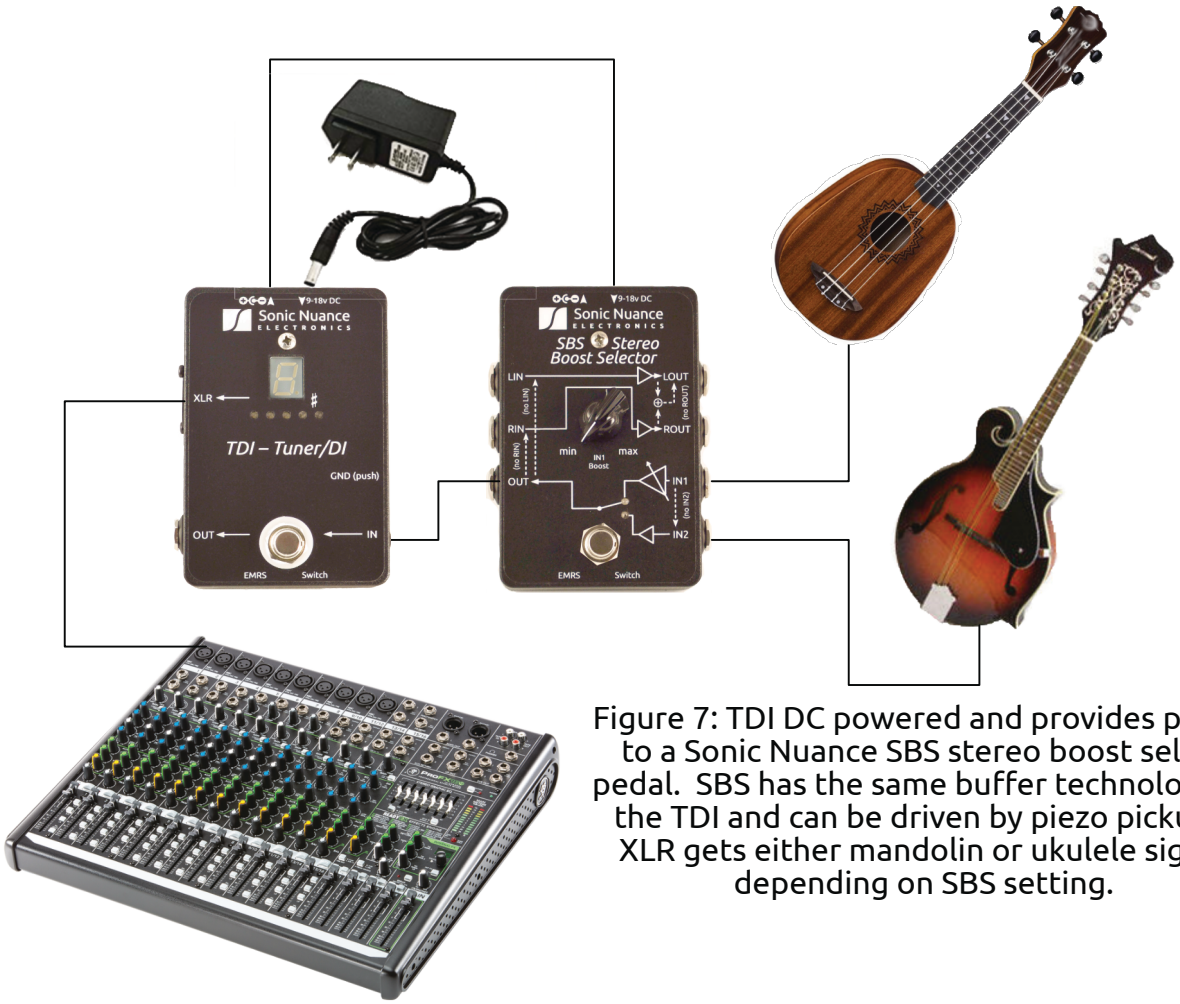

Figure 7: TDI DC powered and provides power to a Sonic Nuance SBS stereo boost select pedal. SBS has the same buffer technology as the TDI and can be driven by piezo pickups. XLR gets either mandolin or ukulele signal depending on SBS setting.

Additional Design Information

I spent a lot of time designing the signal path to make it as low noise, and transparent as possible as I didn't want the TDI to color the signal in any way. In doing so I changed from a typical “hard" mode switching scheme using latching foot switches which wear out to using electro mechanical relays with foot switch actuators and “soft" switching. This was more expensive but more reliable and consistently quiet during switching. The circuit uses a combination of high reliability and noise immune discrete digital circuits combined with low signal mechanical relays with over 10 million cycle lifetimes. The foot switch actuator used in the design translates up to 500 pounds to about 100 grams of force on the internal circuit board. This virtually eliminates wear and tear to the TDI's internal circuits due to switching. I call this switching scheme EMRS (electro mechanical relay soft) switching. I don't claim to have invented this approach, I just couldn't find an easier way to describe it.

I also maximized the range of the XLR-derived power supply to allow the high end op amps to maximize their dynamic range and minimize distortion. The circuit is able to be powered via a DC adapter from 9V to 18V for extra headroom. Because the input impedance is quite high, piezo pickups can drive the TDI directly. I also added a DC output so that this “accessory” pedal doesn’t use up a precious DC power line on effects boards.

Finally, I ask that you not tighten any of the screws unless they are obviously loose. Thread locking compound was used in many cases and over tightening could damage the unit. -Ted

Specifications (Typical Values Unless Stated Otherwise)

Frequency Response (+/-0.5dB)	20~20kHz
Input Impedance	2Meg ohms
Output Impedance XLR & 1/4”	200 ohms
Maximum Input	10dBu @ 1kHz
XLR Output	Buffered impedance balanced, low noise, high slew rate, high dynamic range
1/4” Out	Buffered, transformer isolated, low noise, high slew rate, high dynamic range
Tuning Range	E0-E5 (~20Hz to ~660Hz) (below low B of bass to 12th fret high E string of a standard tuned guitar)
Tuner Accuracy	+/- 1 cent minimum
Power Requirements	XLR: 48V (P48) IN: 9-18V 100mA min
Maximum DC out current	Limited by the smaller of the DC IN’s supply or 300mA
Mechanical Relay Lifetime	10,000,000 cycles min
Warranty	Three years limited. See website for details

California Proposition 65 Requirement

To meet the requirements of California Proposition 65, it is our responsibility to inform you of the following: WARNING: This product contains chemicals known to the State of California to cause cancer, birth defects or other reproductive harm. Please take proper care when handling and consult local government regulations before discarding.

EMC Notice

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

— Reorient or relocate the receiving antenna.

— Increase the separation between the equipment and receiver.

— Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

— Consult the dealer or an experienced radio/TV technician for help.

Sonic Nuance
ELECTRONICS

Hear Everything, Always
www.sonicnuance.com