

**HZ-10SE Preamp System  
For Acoustic Instruments  
(Stereo Effects)**

**OPERATING MANUAL**

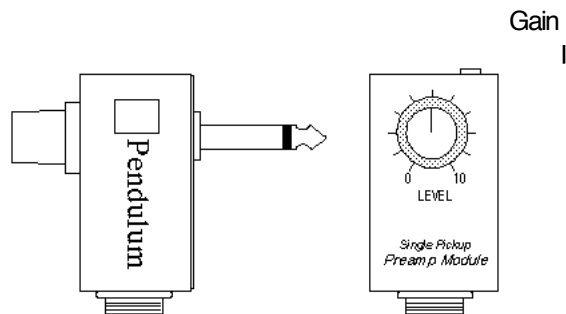
**Serial No.**

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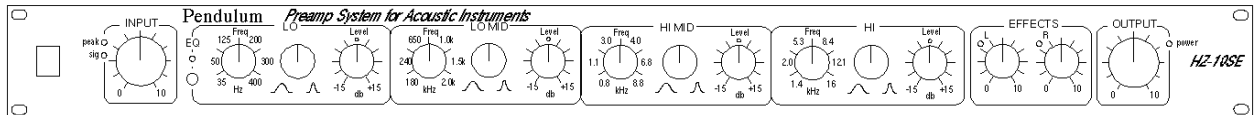
# CONDENSED OPERATING INSTRUCTIONS

## Preamp Module

- **LEVEL CONTROL:** The level sets the of signal that is sent to the Main Preamp Unit. The level is adjustable from 'off' to maximum.
- **GAIN CONTROL:** The gain control is a screwdriver-adjustable trim control that sets the amount the guitar pickup output is amplified by the Preamp Module. The gain is adjustable from 0 dB for high level pickups, to +20 dB for low level transducers. With the INPUT control on the Main Preamp Unit turned all the way down, and the Level control turned all the way up, adjust the Gain control below the level that causes the red 'peak' LED to flash.



## Front Panel Controls



- **INPUT CONTROL:** The Input control sets the operating level within the Main Preamp Unit. Set the Input control so the signal level stays between the limits set by the Signal and Peak LEDs. The unity gain setting is 12:00.
- **SIGNAL:** The green "signal" LED indicates that the signal level at the input stage is above the lower limit for normal operation (-20 dbu). The input level should be set so the signal LED is on most of the time. This should be at about 12:00 on the Input control, if the Preamp Module Gain control is set properly.
- **PEAK:** The red 'peak' LED indicates the signal level is near the upper limit for normal operation (+14 dbu) at one of the following places in the signal path: Preamp Module output, input stage, equalizer input and output, and effects mixer output. Set the Preamp Module Gain control, Input control, and Effect Level controls so the peak LED flashes only occasionally.

## FOUR BAND PARAMETRIC EQUALIZER

- **ON:** Depressing the EQ pushbutton illuminates the red 'on' LED and puts the parametric equalizer into the signal path. Each of the four bands of the equalizer has three controls:

- **FREQUENCY:** The Frequency control (left hand side) sets the center frequency the band acts on. The frequency ranges are:

LO: 35 - 400 Hz      HI - MID: 800 - 8800 Hz

LO - MID: 180 - 2000 Hz      HI: 1.5 - 16.0 kHz

- **BANDWIDTH:** The Bandwidth control (center) sets how wide or narrow a range of frequencies around the center frequency is acted on. The range of adjustment is:

LO: 0.10 - 1.0 octave

LO-MID, HI-MID and HI: 0.33 - 1.0 octave

- **LEVEL:** The Level control (right hand side) sets the amount of boost or cut ( $\pm 15$  db maximum) that is applied at the center frequency.

## EFFECTS

- **EFFECT LEVEL:** The EFFECTS level controls (L and R) are used to set the level of the stereo effects return inputs. The return inputs are capable of up to 20 db of gain to interface with all types of effects. The unity gain position is 11:00.

- **EFFECTS ON:** The inputs are activated when an effect is plugged into either return input on the rear panel, or switched on by the foot switch. The red LED to the upper left of each control indicates the input is active. The inputs are only active if the Instrument ON switch is also depressed.

### OUTPUT (L/R)

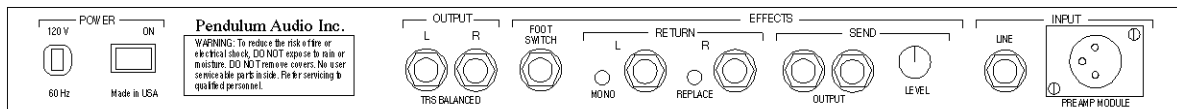
- The **OUTPUT(L/R)** dual control adjusts the Main Preamp Unit's outputs to the level required by the amplifier, sound reinforcement system, or recording console it is used with:

2:00 for professional (+4 dbu) equipment

11:00 for semi-pro (-10dbV) equipment

<11:00 for instrument-level inputs.

## Rear Panel Controls



## INPUTS

- **PREAMP MODULE:** The Preamp Module input is a phantom powered (+48Vdc) balanced-line input for the preamp module. This input should **ONLY** be used with the preamp module, or other sources equipped to use the phantom voltage.

- **LINE:** The Line input is a convenient accessory input that accepts either unbalanced or TRS balanced line signals. The line input allows the Main Preamp Unit to be used as a stand-alone

parametric equalizer with signal sources other than the preamp module. It can also be used as the input for a wireless receiver.

### **DUAL FOOT SWITCH**

- The foot switch jack accepts the stereo plug from the foot switch. Closing either the tip or the ring to ground causes the Instrument ON or Stereo Effects loop to be activated, illuminating the 'on' LEDs on the front panel and the foot switch.

### **OUTPUTS (L AND R)**

- The TRS output jacks allow the HZ-10 to interface with unbalanced and balanced line systems. The outputs are muted for 5 seconds when the power is turned on to minimize turn-on transients.

### **EFFECTS SEND**

- **SEND OUTPUTS:** The two effects send jacks supply a post-equalizer signal to drive the input of the effects units or an instrument tuner. The outputs are muted for a few seconds when the unit is first turned on.

- **SEND LEVEL:** The send level adjusts the output to the requirements of the effects being used:
  - Full level for +4 dbu professional inputs
  - Half way for -10 dbV semi-pro equipment
  - < Half-way for instrument-level effects.

### **STEREO EFFECTS RETURNS**

- **RETURN INPUTS (L AND R):** The two return inputs accept the stereo output signals from the effect unit. The inputs accommodate both low and high level signals.

- **MIX /REPLACE:** The mix/replace mode switch sets up the return inputs for the type of stereo effects used:

The **MIX** mode is for effects that are blended with the unprocessed ('dry') guitar sound (e.g. reverb, delay).

The **REPLACE** mode is for effects that are meant to replace the 'dry' sound (e.g. compressor/limiter), or effects that have their own 'mix' feature that blends the effect with the dry sound inside the effect unit (e.g. a multi-effects processor).

## **Introduction**

The HZ-10SE is the first professional-quality preamp system designed specifically for acoustic instrument pickups. It consists of a 'front-end' instrument preamp (Preamp Module), a rack mountable Main

Preamp Unit that contains a four band parametric equalizer and a stereo effects interface, and a dual foot switch. By combining these components into an integrated system, we've created a preamp/processor that is versatile, easy to use, and most importantly, unmatched in sound quality. When used with the current generation of high impedance transducers, magnetic pickups and/or mini-mics, the HZ-10SE Preamp System makes it possible to get clean, natural, balanced sound from your instrument - sound you thought could only be obtained in the studio. And since the system is modular, it can easily be adapted to any type of pickup system you'd like to use, simply by changing Preamp Modules. Whether your instrument is equipped with a piezo transducer, mini-mic, magnetic pickup or a combination of two pickups, there's a Preamp Module designed for it.

## Why We Designed the HZ-10SE

Over the years, acoustic instrument pickups have gotten mixed reviews. Some of the criticism of course is justified. The first generation of piezoelectric transducers, although capable of more natural sound than their predecessors, left a lot to be desired; they were prone to hum pickup because of insufficient electromagnetic shielding, and quite often their size or placement geometry prevented them from giving a good representation of the harmonic balance of the instrument. And since they have a very high impedance output, connecting them through a few feet of shielded cable readily degraded their sound. Even though the problem is less severe for magnetic pickups, their clarity can also be compromised with improper impedance matching. One solution to these problems was to use a battery-operated preamp put on the floor, held on a belt-clip, or somehow implanted into the instrument. However, these units were often designed primarily for long battery life rather than high performance. But in spite of all this, piezo transducers and magnetic pickups were convenient for live performance, so acoustic players put up with these limitations. Often, these limitations forced performers to go back to using stand-mounted microphones, and putting up with leakage and feedback headaches.

### Piezo and Magnetic Pickups

With the current generation of pickups however, most of the shielding, placement, and other problems have been addressed. In fact, a number of well-known recording artists, producers and engineers have discovered that in the studio is possible to get natural, high quality sound from these pickups - sound that some actually prefer to that obtained from a condenser microphone. The key to getting studio-quality sound is in the way the signal from the pickup is handled, and in this regard, the conventional preamp technology has not kept pace with the advances in pickup design.

At Pendulum, we decided to improve on the conventional 'low fidelity' approach. We designed our **Preamp Module** to handle high impedance pickups the way one would handle a low level, high impedance source in the studio (such as the capsule of a condenser microphone, for example). To do this, we:

- **Put the 'front-end' Preamp Module at the instrument:** this avoids the loss of fidelity that occurs when the high impedance signal is run through a long instrument cable. The Preamp Module is available in a number of configurations, so the system is compatible with all acoustic instruments.
- **Made the Preamp Module phantom-powered:** Aside from the obvious convenience, this has other advantages over battery powered units, such as being able to operate with greater headroom and dynamic range, and not being limited to using less than ideal circuitry chosen for low battery consumption rather than high fidelity.
- Designed it for a **balanced line output:** With a low impedance, balanced line signal, you are able to run a very long signal cable to the Main Preamp Unit without degrading your sound.
- Optimized the circuitry for **extremely low noise operation** at high impedances. The module is so quiet in fact, that the pickup's self-noise contributes more to the total noise than the preamp itself!

In doing this, we also gain a few 'extras':

- **Portability:** You can have all the benefits of an implanted preamp without modifying your instrument, and you can use it with all your acoustic instruments.
- **Level Control:** By putting a volume/gain control within easy reach, the preamp module can be optimized for any pickup output, and allows you to adjust the instrument volume at your playing position.

## Mini-Mics and Dual Pickup Applications

Some players prefer the sound of a microphone, usually blended with a pickup, and the current generation of mini-mics makes it easier to use them on acoustic instruments. However, most mini-mics mounted inside acoustic instruments are used without the manufacturer's electronics (in the so-called 'pig-tail' configuration) and connected directly to an endpin jack. When connected like this, the microphone is a lower impedance source than a piezo transducer, but still high enough to require some sort of preamp stage close to the instrument to act as a gain boost, and provide the mic with power.

- Our **Mini-Mic Preamp Modules** are designed to work with all currently available 3 wire mini-mics in a **2-wire hookup** (so you can use a 3-wire stereo endpin jack to connect to both the pickup and mic).
- The Module is also designed to **supply power to the mini-mic**, so internal batteries are eliminated.
- Like the piezo and magnetic modules described above, the mini-mic modules (single or dual pickup) are designed for **extremely low noise** operation, have a balanced line output, and an easy to reach level control.

## Main Preamp Unit

Once the pickup or mini-mic output is in a more manageable form, our next concern is to **process the signal to retain their sound quality and restore the natural tonal balance of the instrument**. In the studio, this would mean sending the signal into one channel of a high quality mixing console, where it could be equalized, and sent to an effects bus for additional signal processing.

This is precisely what we designed the rack-mountable Main Preamp Unit to do, and we also added a number of special features with the acoustic player in mind:

- We designed in a **Four Band Fully Parametric Equalizer** that's been optimized for use with an acoustic instrument. We gave it the flexibility that is essential for restoring the natural balance of your instrument, and made it more versatile (and we think better sounding) than the EQ in most studio boards.
- Then, we added a **Stereo Effects Interface** to make it easy to process the mono signal from your pickup(s) into full stereo: everything from on-the-floor boxes to high quality rack-mounted signal processors. Unlike a simple effects loop, this effects interface is designed to accept both categories of effects - those meant to **replace** the unprocessed instrument sound, and those you want to **mix** with it. The interface can also be run in the **MONO** mode, to operate as two mono effects loops.
- And, the **Dual Foot Switch** lets you mute your instrument and control the stereo effects interface from your playing position.

First and foremost however, we made sure that each segment of the signal path was designed for **exceptional audio performance**, to insure that the HZ-10SE is as 'at home' in the studio as it is on stage. We think that paying attention to the details makes a big difference - one that you'll be able to hear each time you pick up your instrument.

## Unpacking

The unit was carefully packaged at the factory to protect against damage in transit. Nevertheless, be sure to inspect the unit and shipping carton for any signs of damage that may have occurred during shipment. If there is any damage, notify us immediately for further instructions. It's also a good idea to save the carton and packing should you ever need to return the unit for repair.

The shipping carton should contain the following items:

- The HZ-10SE Main Preamp Unit
- Preamp Module with connecting cable
- Dual foot switch
- This Operating Manual

## Initial Setup

The HZ-10SE's setup is rather straightforward. However, you may find it useful to refer to the block diagram on page 16 to identify how the controls on the front panel of the Main Preamp Unit affect the signal flow.

### Hookup

- Connect the 3 pin mini-connector end of the 18' cable to the Preamp Module.
- Connect the male XLR connector end of the cable to the phantom-powered input labeled 'Preamp Module' on the rear panel of the main unit. **CAUTION:** *This input should be used only for the preamp module or other sources equipped to use or block the phantom voltage.*
- Connect the Main Preamp Unit output via the 1/4" output jack on the rear panel to the method of amplification you're using : i.e. high level (line) input of sound reinforcement system, studio mixing console, or high level input of your amplifier, or even your stereo system. Or if you prefer, the main output can also be used to drive a set of headphones.

Note: The output jacks (Left, Right) allows either **unbalanced** or **balanced** line operation:

Unbalanced operation: 1/4" mono phone plug

Balanced line operation: 1/4" stereo (tip-ring-sleeve) phone plug

Tip = XLR pin 2, Ring = XLR pin 3, Sleeve = XLR pin 1.

- Connect the input of the Preamp Module into the pickup output connector on your instrument. Depending on the version of Preamp Module you've selected, you will either plug the Preamp Module directly into the instrument's 1/4' endpin jack (Endpin Jack version), or use a short cable between the instrument and Preamp Module (Belt-clip version). Other versions of the Preamp Module, such as the HZ-10(I) implant or the HZ-10(D) dual pickup module, come with detailed instructions on their installation, hookup and use. Refer to the instructions supplied with these modules.

## Control Settings

Before turning the HZ-10SE on, we recommend that you set the Preamp Module and Main Preamp Unit controls as follows:

**Preamp Module:** Knob = 0 (off).

**Main Preamp Unit:**

<u>Front Panel</u>	<u>Rear Panel</u>	
Input control: 0	EQ controls: centered	Effects send: centered
Effects L, R: 0	EQ switch: out (off)	Mix/replace: out (mix position)
Output (L/R) control: 0		

After plugging the unit into a grounded 120V receptacle, turn the HZ-10SE's power on via the rear panel power switch. The yellow 'power' LED on the front panel should be illuminated. [Note that both the main and effects send outputs contain mute circuitry to minimize turn-on transients ('thumps'). The outputs are muted for about 3 seconds, allowing the voltages within the unit to stabilize.]

## Setting the Preamp Module Gain

The Preamp Module is designed to interface with pickups or mics having both low and high output level, by proper adjustment of the gain control. Setting the **Maximum Level** for your pickup is done as follows:

- First, be sure the input control on the Main Preamp Unit turned all the way down so that there's no signal passing through it. And, if there is a level control on the instrument (from an on-board preamp), be sure that is turned all the way up.
- Next, strum your guitar at the loudest level you'll be playing and slowly turn up the gain control on the Preamp Module. At a certain point, the red 'peak' LED on the front panel near the input control may begin to flash. This indicates the signal level is within 6 dB of overload (+14 dBu).
- Then, back off a bit (about one division) from this position. This will assure enough headroom remains, since guitarists often end up playing a lot louder than when they set up!

At this point, the Preamp Module's Gain is properly set for your pickup. A few things to keep in mind; with very low level transducers, the 'peak' LED may only flash rarely even with the gain control all the way up. This is OK. On the other hand, very high level pickups will require much less gain. Note that the Gain control provides a convenient way of adjusting your volume or turning the instrument off from your playing position. Just keep the Gain control below this maximum level setting to prevent overload distortion. If your module came with special instructions - please refer to those for proper set-up and operation.

## Setting the Operating Level in the Main Preamp Unit

### Input Level

The green 'signal' and red 'peak' LEDs are used to establish the proper signal level in the Main Preamp Unit:

- As you strum your guitar, turn up the Input control on the front panel of the HZ-10SE until the 'signal' LED begins to flash. This indicates the signal level is at the lower limit of the normal operating range



(-20 dBu) .

- Continue to turn up the input control until the peak LED begins to flash, indicating a level of +14 dBu (about 6 dB below overload), the upper limit for normal operation.
- Then, back off to a position on the Input control about midway between the upper and lower limits set by the two LEDs. This should be near the 12:00 position, if the Preamp Module gain has been adjusted properly. In normal use, the green 'signal' LED should be on most of the time while you play, with the red 'peak' LED flashing only rarely.

## Left/Right Output Levels

The Output (L/R) control can now be set to a level convenient for interfacing with your method of amplification. This will typically be the high level ('line' or 'accessory') input on your mixing board, amplifier, or tape recorder. The unity gain setting on the output control is the 2:00 position; this is the ideal level for interfacing with professional, balanced line systems. For unbalanced operation with semi-pro (-10 dBV) systems, you will probably find a level setting of about 10-11:00 to be more appropriate. Check the requirements of the equipment you'll be using it with for more information. Remember, the output is muted for about 3 seconds when the unit is turned on. Note: You can also plug a set of headphones directly into the Output jacks (with an appropriate adapter) of the Main Preamp Unit. It's a convenient way to monitor the sound of your instrument when setting up the HZ-10SE.

## About the Peak Indicator

Rather than sensing only input overload (as is usually the case), the HZ-10SE's peak detection circuitry warns of levels near clipping at a number of key places in the signal path: the Preamp Module output, input stage, equalizer input and output, and effects mixer. It's okay for the peak LED to flash occasionally, since there's still 6 dB of headroom above this point before clipping. If the peak LED stays on for long periods, however, you have probably:

- Set the Input control too high.
- Set the Output control too high.
- Set the Preamp Module gain incorrectly (see Setting the Preamp Module Gain).
- Set the Effects L or R Return level(s) too high (more on this later)

Assuming the Preamp Module and Effects levels are set properly, the remedy is to simply turn down the Input control. Be aware that you may also have to readjust the Input level after setting or changing the guitar's EQ with the parametric equalizer, since adding a lot of boost may bring the signal level back near overload.

## Using the Four Band Parametric Equalizer

Why have we chosen to use a parametric equalizer in the HZ-10SE? Well, regardless of which pickup system you use, or how they're installed, certain overtones will be exaggerated at the expense of others. Only a parametric equalizer has the flexibility that is essential for restoring the natural harmonic balance of your acoustic guitar. You'll find that the HZ-10SE's four band parametric, with its overlapping frequency bands and variable bandwidth, gives you enough freedom to accurately tailor the equalizer's response to the unique needs of your instrument/pickup combination.

## Controls

The HZ-10SE's parametric has four bands: LO, LO-MID, HI-MID, and HI. Within each band there are three controls; the FREQUENCY control (left hand side) sets the center frequency band is acting upon; the bandwidth control (center) determines how wide ( ) or narrow ( ) a region around the center frequency is affected; and the LEVEL control (right hand side) determines the amount of boost (clockwise) or cut (counterclockwise) is applied at the center frequency. The table below indicates the range of operation of the various controls of each band:

Band	Frequency Range	Bandwidth (-3 dB)	Q (= 1/BW)
Lo	35 - 400 Hz	1.0 - 0.10 octave	1 - 10
Lo - Mid	180 - 2000 Hz	1.0 - 0.33 octave	1 - 3
Hi - Mid	800 - 8800 Hz	1.0 - 0.33 octave	1 - 3
Hi	1.5 - 16.0 kHz	1.0 - 0.33 octave	1 - 3

There are two things to note; first, the four frequency bands have considerable range (about 3 1/2 octaves) and overlap - that is, the LO-MID band can also be used in the upper range of the LO band, and so on for the other bands. This gives you added versatility, e.g. if one band is dedicated to removing a objectionable band of frequencies, another band may be applied to access other frequencies nearby. Also note that the LO band is capable of a narrower bandwidth (larger 'Q') than the others; this is important for using the LO band to 'notch' out hum, or to deal with the instrument's 'body resonance' (as will be discussed below).

To put the equalizer into the signal path, depress the 'EQ' pushbutton to the right of the Input control - the red LED above it indicates the EQ is on. With the level controls centered, the equalizer is inactive and you guitar should sound no different than with the EQ off. Rotating the LEVEL control to either side of the center detent position will boost or cut in the range selected by the frequency and bandwidth controls. Choosing a wider bandwidth ( ) will encompass more frequencies, causing a more audible effect on your guitar's sound - more like that observed with one band of a graphic equalizer or a tone control with a 'peaking' response. With a narrower bandwidth ( ), fewer frequencies are affected, so more boost or cut has to be applied to notice a large difference in your guitar's sound. However, the narrower bandwidth lets you be more selective about the frequency range you want to target - giving you an extremely effective way of eliminating unpleasant resonances without affecting other areas of the frequency spectrum.

# Equalizing your Acoustic Guitar

## Comments

Before you start to equalize your instrument's sound, it's probably a good idea to:

- **Listen carefully to your instrument unamplified.** Try to decide what it is you like about the way it sounds, and target any potential problem areas you feel might need fixing. This will give you a clearer sense of what you want the equalization to achieve.
- Try to **get the best sound that you can from your pickup(s) before applying any EQ.** This includes (if possible) trying it in different locations or even trying different pickups, to get the most balanced sound possible. Remember, it's best to use only as much EQ as necessary; when less has needed to fix major problems, more is available to accent the good points.

It's also a good idea to perform the initial EQing by listening through a pair of high quality headphones (which can be plugged into the main outputs - use the proper adapter), or in a quiet, controlled environment (like your living room or home studio). This is the best way to judge the effect that various control settings are having on your sound. If you're planning to use the HZ-10SE onstage with a sound reinforcement system, setting up this way first is important: it will help you distinguish problems with the sound from your guitar and pickup system from deficiencies in the sound system.

## Main Problem Areas

Since the requirements of each instrument and pickup system are unique, it's difficult to pinpoint specific EQ settings that will work for everyone. However, we have found that most of the problems fall into one of four main categories. Here are a few hints on how to use each of the four bands you have available to handle them:

- **Lack of 'Warmth'/Too Much 'Boominess'**

Tuning the **LO** band to the instrument's **body resonance** (typically in the range of 70-140 Hz) is an extremely effective way of **restoring the natural bottom end missing from the sound of some pickups**. To do this, set the bandwidth control fairly narrow (around 3:00) and add 12-15 dB of boost. Then, lightly tap a finger on the top of the guitar behind the bridge while tuning the FREQUENCY control in the range given above (the larger the guitar's body, the lower the resonant frequency). At a certain point, the tapping will turn into a deep 'thud' as you zero in on the body resonance. (If you listen closely, you'll actually hear a series of harmonically-related resonances - tune in on the lowest frequency one.)

Now, play a few chords and adjust the bandwidth and level to your liking, while using the EQ in/out switch for comparison. The improvement is usually dramatic. With a very narrow bandwidth, you can add a well-balanced hint of bottom end without a lot of 'boominess'. Or, you may prefer a wider bandwidth to accentuate the low end more; this more closely simulates the proximity 'bass boost' you're used to hearing when a cardioid microphone is aimed at the soundhole.

On the other hand, **some players often experience problems with an overpowering low end 'boominess', especially with a mini-mic in the body of a guitar, or piezo pickup stuck to the top.** To deal with this, perform the same procedure described above to find the objectionable frequency (it shouldn't be difficult!). Cut the level and adjust the bandwidth to remove as much of this frequency range as necessary. You should be able to find a setting that effectively removes the problem without affecting the rest of the bottom end.

- Lack of 'Clarity'

Often, because of the pickup's response or placement, the guitar's lower midrange overtones get exaggerated. This causes your guitar to sound 'muddy' and lack definition. Use the **LO-MID** band (with a fairly wide bandwidth) to cut a few dB in the 400-1000 Hz frequency range.

- Lack of 'Presence'

Using the **HI-MID** band to add a few db in the 3-6 kHz range will help your guitar stand out. Be careful though, since adding too much or centering on the wrong frequency can make your guitar sound harsh. On the other hand, some pickups tend to overemphasize frequencies in this range so you may need cut back in this region.

- Lack of 'Brilliance'/Too 'Brittle'

Compared to the hyped-up high end we're used to hearing on recordings, an acoustic instrument can often sounds too 'mellow' to the modern ear. A broad boost of the **HI** band above 10 kHz will give you a 'crisper', 'brighter' tone. Applied in moderation, it can bring life to a dull-sounding instrument. On the other hand, some saddle-mounted piezo transducers have an annoying harshness in the upper register. Cutting the highs judiciously can tone down the 'breaking glass' syndrome.

**Remember, EQ is largely a matter of personal taste and the specific needs of your instrument may be quite different from these general guidelines.** Don't be afraid to experiment to find what sounds the best to you.

## A Few Words about Piezo Transducers

A few points to keep in mind:

- **Not all transducers are capable of delivering natural, balanced sound.**
- **The transducer location/installation is very important.**

As you're probably aware, the sound you get from your transducer is very sensitive to where it's positioned (stick-on pickups) or how it couples to the bridge (under the saddle pickups). Small changes can dramatically change the sound you get.

With small (but low output) **stick-on pickups** you can be selective and hunt around for the best-sounding position, usually on the treble side of the bridge. However, they all suffer form '**body noise**' problems - that is, the body of the instrument and the transducer cable are very sensitive to handling, and the instrument is prone to feedback. One of the problems we've encountered with some so-called 'high output' stick-on transducers ('no preamp required') is that they achieve their high output because they're large and in contact with a large area of the instrument. Since they end up averaging vibrations over a large area, that section under the pickup with the highest amplitude of vibration dominates the sound. Unfortunately, the sound that dominates often ends up being mostly midrange. It's loud, but not very pleasant.

**Under the saddle or saddle replacement pickups** are very popular since body noise and feedback are reduced significantly. However, **not all these transducers are created equal when it comes to shielding and sound quality.** Under the saddle pickups sometimes suffer from the sound one or more strings being louder than the others. And, with changes in temperature and humidity, the coupling of the pickup to the saddle can change as well. Saddle replacement pickups reduce this problem considerably, but installation is often more difficult. **All this said, we have been able to get truly superb sound from some piezo pickups!**

## Hum and Shielding

A properly designed piezo transducer or magnetic pickup should be shielded against electromagnetic interference (EMI), which causes hum and noise. **When the HZ-10SE is used with a well-shielded pickup, there is no hum, period.** Too often however, the shielding is inadequate or nonexistent. This is unfortunate, because a number of rather inexpensive pickups sound quite good except for their lack of shielding. Although it's possible to use the LO band to try to 'notch out' 60 Hz hum, it also ends up removing some bottom end in the process, and you have a harder time taking advantage of the 'body resonance' technique discussed above. Here's a quick way to test the shielding on your pickup:

- Set up the HZ-10SE to hear your guitar at normal listening level with the EQ off.
- Put the area of your guitar where the pickup is mounted about 12" from a fluorescent light (an ideal broadband noise source).
- If the transducer is properly shielded, there should be very little or no hum. If it isn't, you'll know it.

**What can you do if it's not properly shielded?** It depends on the type of pickup; if it's a magnetic pickup or a piezo transducer implanted in the bridge or mounted under the saddle, not much except to try a different pickup. If it's a stick-on pickup, you can (if you're adventurous) remove the pickup and try the following:

- Wrap a single layer of aluminum foil around the pickup, and lead a thin wire from the foil shield to the ground connection on the pickup's plug or guitar jack. Then, remount the pickup. It's not the prettiest solution, but it works quite well (and you could use a 'decorative' type of foil).
- A better solution is to apply an black EMI spray coating to the transducer (e.g. Miller-Stephenson RFI Conductive coating #MS-485 or equivalent, available at your local electronic supplier). *Caution - don't try this unless you're willing to suffer the consequences if something goes wrong! Don't try this if the piezo crystal and its connections aren't totally encased in an insulated (plastic) housing!* Before applying the coating, attach the bared end of a thin wire to the transducer. It will act as the ground contact to the coating applied over it. Apply a few light, even coats, according to the instructions on the can. When completely dry, it becomes a conductive and will shield against hum and other interference. Be sure to ground the other end of the embedded wire when you remount the pickup. We've had excellent results using this technique, making some very inexpensive transducers sound great.

**Note: Often, hum problems can be traced to improper shielding of the connection of the pickup wire at the endpin jack. To remedy this, shield the signal pin with a piece of electrical tape, and crimp a piece of aluminum foil around the area, making sure the foil is grounded to the sleeve of the jack.**

## Stereo Effects Interface

The stereo effects interface is designed to make it easy to use all types of two output effects processors. The signal levels can be set to accommodate everything from the on-the-floor effects boxes you're used to using, to high-quality rack-mounted signal processors. And its unique switching matrix lets you distinguish between the two general categories of effects: those that are meant to 'replace' the unprocessed guitar signal, and those you want to 'mix' with your guitar sound. By using the remote foot switch, you can conveniently keep your effects back at the rack with the Main Preamp Unit and still have control over them at your playing position.

## Hooking Up your Effects

Rather than acting as a simple effects loop, the HZ-10SE's stereo effects interface is set up with the send and return capability of a mixing board. The effects are interfaced via the 1/4" phone jacks labeled 'Send' and 'Return' (Left and Right) at the rear of the Main Preamp Unit. The mono send outputs (two, so you can drive the two halves of the stereo chain separately) deliver a post-EQ guitar signal to the effects. Alongside these outputs is the Send Level control, for adjusting the output level to what's required by the input of the effects you're using. Near the two effect Return inputs (L and R) are the Mix/Replace and Mono 'Mode' switches (which are discussed in detail below). The Return levels are set by the L and R EFFECT controls on the front panel. The inputs are capable of up to 20 dB of gain to accommodate even low output effects, with the unity-gain setting is the 11:00 position.

### Connect the Effects as follows:

- **Connect one of the Effect Send Outputs to the line, or high level input of your outboard stereo effect(s).**  
Set the send level to that appropriate for the requirements of the effects unit; all the way up for +4 dbu pro equipment, and about mid-way for -10 dBV semi-pro gear (refer to the effect's operating manual for more details). Note that the effect send output (like the main output) has a 3 second 'mute' when the power is first turned onto minimize turn-on transients.
- **Connect the effect unit's two outputs (line or high level) to the L and R Effect Return inputs.** The red LEDs on the front panel near the level controls of the two Returns will light, indicating the input is active. If the foot switch is connected, the input is activated by turning on the Effects foot switch, with the instrument ON switch also activated. Set the L and R Return controls to the levels and relative L/R balance you desire.
- **Note that the 'peak' indicator is also used to monitor overload in the Effect Returns.** Like the Input control, the peak LED will flash if a return level is set too high. If turning down the Effect Return level doesn't fix this, then the problem is not with the effects: go back and check the Input level and Preamp Module Gain settings.

### Mix / Replace Mode Selection

Between the L and R Return inputs is a pushbutton switch that allows you to select either of the two categories of effect loop you're using:

- **MIX mode** ( ): Use this setting for an **effects loop you want to blend with the 'dry' guitar signal** (e.g. a reverb or delay device). In this mode, the unprocessed ('dry') guitar sound remains in the HZ-10SE signal path.
- **REPLACE mode** ( ): Use this setting when you want to **replace the 'dry' guitar sound with the signal processed by the effects loop** (e.g. a compressor/limiter, stereo chorus or multi-effects processor). In this mode, the 'dry' signal within the HZ-10SE is turned off when the returns are activated.
- Some effects include a 'mix' control that lets you blend the 'dry' sound with the effect inside the effect unit. Use the REPLACE mode if this feature is used. Sometimes it may be more convenient to use this than doing the mixing in the HZ-10SE. Be aware, however, that **the quality of the 'dry' sound passed through the effect is often not as good as when the signal is passed directly through the HZ-10SE**. If this is the case, turn the 'mix' control to output the only the 'effect' signals and use the HZ-10SE's MIX feature.

To better understand how this switching matrix works, think of the system as having two 'channels': one for the unprocessed guitar sound, and one for the stereo effect returns. When the returns are operated in the MIX mode, the unprocessed guitar channel remains switched in and the effects are blended with it. If the REPLACE mode is selected however, the unprocessed channel is switched off, and only the returns are active. The advantage of this scheme, of course, is that the internal logic does all this switching for you automatically when an effects loop is switched in - making it easy to use and control all categories of effects.

## More About the Switching Matrix

Conventional analog signal switching relies on field-effect transistors (FETs) in series with the signal path. Unfortunately, FETs are notorious for adding distortion due to their nonlinear behavior. The HZ-10SE, however, utilizes FETs in a shunt switching mode, which effectively *takes them out of the signal path* when activated. The result - silent switching without FET-induced distortion, to insure the best sound possible from the HZ-10SE, and your effects.

## Mono Effects Mode

By depressing the 'MONO' switch on the rear panel, the effects interface operates as two mono effects loops in parallel with the instrument signal. Both the Left and Right jacks are active and have the same output signal. You can use this mode to obtain a split output feed - for driving a stage amp and sound reinforcement system at the same time without using a splitter box.

## Dual Foot Switch (Instrument ON/Effects)

The HZ-10SE's dual foot switch is used to turn your instrument on and activate the stereo effects loop from your playing position. It's connected by plugging the stereo phone plug into the Foot Switch jack at the rear of the Main Preamp Unit. When the Instrument ON switch is depressed, the LED on the foot switch is illuminated and the instrument signal is passed through to the HZ-10SE Output. When the Effects switch is depressed, the effect 'on' LEDs on the Main Preamp Unit (near the Return level controls) and the foot switch are illuminated, indicating the stereo loop is active. Note that the stereo effects loop is only active when the Instrument ON switch is also depressed. If the Instrument is 'off' and the Effects foot switch has been depressed, the LED on the foot switch will indicate the loop is selected, but it will not be activated (or the front panel LEDs turned on) until the instrument ON switch is also depressed. This is done so the L and R Outputs of the HZ-10SE are muted completely when the Instrument switch is 'off'.

Although the foot switch is supplied with a 18' cable, much longer cable runs are possible. Use a 3 wire unshielded extension cable with 1/4" stereo connections (a stereo feed in a 'snake' cable will also work well).

## Hooking up your Instrument Tuner

**It is convenient to use the Effect Send output to drive your tuner.** Since the Send Output is always active, **you can tune your instrument when you've switched off the instrument with the foot switch.** The low output impedance allows you to 'y' off of the Send Output (or use the extra send output jack) without reducing the signal level to your effects.

## Using The HZ-10SE With A Wireless System

Although the best sound quality is achieved when using the phantom-powered Preamp Module and connecting cable, the HZ-10SE may also be used with a wireless system. Hooking up the HZ-10SE Main Preamp Unit to the wireless is done as follows:

- Be sure to **disconnect the phantom-powered Preamp Module from the Main Preamp Unit** (the **PREAMP MODULE** Input on the rear panel), or **turn the gain control off if the instrument is not in use.**
- Connect the output from the wireless receiver to the LINE input on the rear of the HZ-10SE Main Preamp Unit (the 1/4" phone jack next to the input jack you normally use).

If the receiver has an output level control (or selector switch), make sure it's turned all the way up (or set to the 'high level' position) so the Main Preamp Unit is getting enough signal.

- Connect your instrument to the wireless transmitter. If you're using an instrument that already has a piezo pickup and an onboard (battery-powered) preamp, the transmitter can be connected directly to the instrument. The same holds true for a mini-mic and a mic transmitter.

NOTE: Piezo pickups require a preamp before the wireless transmitter input. The pickup output is usually too low to drive the transmitter properly, which increases the noise level. Also, the impedance mismatch between the pickup and transmitter 'loads' the pickup and results in the familiar 'thin' sound due to loss of bass response.

We recommend using Pendulum's SmartCord' Preamp Module between the transducer and the wireless transmitter. The SmartCord is very small, has a 10M $\Omega$  input impedance, a convenient gain control (0-20dB) and plugs directly into the instrument's endpin jack. It is powered by a single 12V lighter battery (typical battery life >100 hrs. ). which is available at Radio Shack. The transmitter plugs into the SmartCord's 1/4" output jack.

- Set the INPUT control on the Main Preamp Unit and the Gain control on the instrument or SmartCord Preamp Module for the proper signal level.
- That's all there is to it!

## Other Features of the HZ-10SE Preamp

### Line Input

For added convenience, an accessory input is included on the rear panel for using the main unit as a stand-alone Parametric Equalizer - a handy 'extra EQ' to have around your studio for tracking or mixdown. The 1/4" phone jack accepts line signals at -10 dBV or +4 dBu. **Note: both the Preamp Module and Line Inputs can be used at the same time.**



## Technical Extras:

- High speed/low noise circuitry used throughout.
- All inputs and outputs are electronically balanced: no transformers in the signal path.
- Audiophile-quality components: metal film resistors, polypropylene capacitors, a minimum number of electrolytic capacitors in the signal path.
- Toroidal transformer for minimum hum.
- Single circuit board construction of the Main Preamp Unit and Preamp Module for high reliability.

## Troubleshooting

The HZ-10SE system is built for high reliability. If you're not getting any sound out of the HZ-10SE, eliminate the obvious things first. Is the unit plugged into an active 120V ac receptacle? Is the power switch on the rear panel on? Have you read the instructions and followed them? Have you tried a different connecting cable and checked your amplification system? Are the Preamp Module Gain, and Main Preamp Unit Input and Output controls turned up? Is the connection between the pickup and its output jack okay? After you're sure the problem isn't one of the above, check the list below. If you still have trouble, contact us.

SYMPTOM	POSSIBLE CAUSE(S)
Power LED not lit with power switch on and unit plugged into an active receptacle.	Power supply malfunction or internal fuse blown (consult authorized service department).
Signal LED does not flash when guitar played.	Preamp module gain too low. Input control not set properly. Preamp module cable faulty. Preamp module faulty. *Test the operation of the main unit by feeding a signal into the Line input.
Signal LED flashes, but no output. mode' with: Effect level not turned up, improperly, or Effect send level turned	An Effect input activated in the 'replace effect not functioning or connected all the way down.
Unprocessed guitar signal heard, but can't get effects to work.	Test effects loop by connecting a cable between a send output and one of the return inputs. Put input in the replace mode and turn up send and return level. You should hear the guitar sound through
the effects input if the loop is working send output and return input. If both effect unit or connecting cables.	properly. Repeat the test with the other functioning, the problem is in the external
Effect LED on front panel does not go on when effect plugged into Effect return input.	Foot switch connected but the input is not switched on - test with foot switch disconnected.

# HZ-10SE Specifications

## Preamp Module

Input(Piezo or Magnetic Pickup):	10 M $\Omega$ , unbalanced
Input(Mini-mic):	47 k $\Omega$ , unbalanced
Maximum Input Level:	+15.5 dBu (4.6 Vrms)
Input Noise:	EIN less than -113 dBu, input shorted
Frequency Response:	+0/-1 dB, 20 - 20,000 Hz
Distortion:	THD less than 0.01% at 0 dBu
Gain:	0 to +20 dB, adjustable
Output:	Balanced, 3-pin mini-connector

## Main Preamp Unit

Inputs:	Preamp Module: 3-pin XLR type, phantom powered. Line in: 1/4" phone jack, unbalanced. Effect returns: 1/4" phone jack, unbalanced.
Frequency Response:	+0/-1 dB, 20 - 20,000 Hz
Distortion:	THD less than 0.01% at 0 dBu
Output Noise:	EQ out, unity gain: less than -93 dBu EQ in, set for flat response: less than -88 dBu
Maximum Output:	+21 dBu, unbalanced +27 dBu, balanced
Outputs:	L/R Outputs: 1/4" phone jack, TRS balanced (XLR optional). Effects Sends: 1/4" phone jack, unbalanced.
Metering:	Signal (green LED): -20 dBu Peak (red LED): +14 dBu
Equalizer:	Four band fully parametric, $\pm 15$ dB boost/cut
Lo:	35 - 400 Hz, 0.10 to 1.0 octave (Q = 10 to 1)
Lo - Mid:	180 - 2000 Hz, 0.33 to 1.0 octave (Q = 3 to 1)
Hi - Mid:	800 - 8800 Hz, 0.33 to 1.0 octave (Q = 3 to 1)
Hi:	1.5 - 16 kHz, 0.33 to 1.0 octave (Q = 3 to 1)
Phantom Power:	+48 Vdc applied to pins 2 and 3
Foot Switch:	1/4" TRS phone jack, 10 ma current loop.
Power:	120 VAC, 10 Watts

## Dimensions

Preamp Module:	1.1" x 2.2" x 1.0", excluding input plug.
Main Preamp Unit:	1.75" x 19" x 6" (one standard rack space)
Foot Switch:	4.3" x 2.3" x 1.2"

Note: 0 dBu = 0.775 Vrms. All noise measurements are unweighted, 20 - 20,000 Hz bandwidth.  
All specifications are subject to change without notice.

## Limited Warranty

Pendulum Audio, Inc. warrants to the first purchaser of a new Pendulum HZ-10SE Preamp System that the unit is free of manufacturing defects in materials and workmanship for a period of one (1) year from the date of purchase. Pendulum Audio, Inc.'s sole obligation under this warranty shall be to provide, without charge, parts and labor necessary to remedy defects, if any, which appear within one (1) year from the date of purchase. All warranties expressed or implied made by Pendulum Audio, Inc., including warranties of merchantability and fitness, are limited to the period of this warranty. Pendulum Audio, Inc. is not responsible for indirect, incidental or consequential damages arising from the use or failure of this product, including injury to persons or property.

This warranty does not cover damage due to: misuse, abuse, modification, accident or negligence. The warranty does not apply if the unit is repaired or altered by persons unauthorized by Pendulum Audio, Inc. in such a manner as to injure, in Pendulum's sole judgment, the performance, stability or reliability of the unit. The warranty does not apply if the unit is connected, installed or used otherwise than in accordance with the instructions furnished by Pendulum Audio, Inc.

If the equipment requires warranty repair, return authorization must be obtained from Pendulum Audio, Inc. prior to shipment. Equipment should not be shipped to Pendulum Audio, Inc. until return authorization and the proper shipping address is obtained from us. The equipment (with all its components parts and connecting cables) must be suitably packaged, including a note with the owner's name, address, telephone number and a description of the reason for return. You pay two-way shipping (we recommend UPS), and we suggest you insure your shipment.

This limited warranty is in lieu of all other warranties, expressed or implied, and no representative or person is authorized to represent or assume for us any liability in connection with the sale of our products than set forth herein. This limited warranty gives you specific legal rights, and you may also have other rights which vary from state to state.