

---

## Sixgate Application Notes

---

### What is a Noise Gate and Why use them?

If we strip away all the flashing LEDs, esoteric Key filter sets, Midi interfaces, etc. and get to the bare bones of it all, a Noise Gate is actually just a switch. It allows an audio signal to pass through when we want it to, and stops or attenuates the audio signal passing through when we don't want it to.

The secret of making the Noise Gate more than just a simple on/off switch (not unlike that of a simple AC power switch) is the control we can have over its operating parameters. These are:

- How fast it opens (Attack time)
- How fast it closes (Release time)
- When it is off, then how off it is (Attenuation or Depth)
- When we want it to open or close (Threshold)

These are the basic operating functions of a Noise Gate. Some manufacturers offer you less, some offer you more. At ARX we decided to offer you more gates, plus the features you can use out there in the real world.

### Why SIX gates?

When we designed the Sixgate we first asked audio professionals for what applications they usually used noise gates.

The answer we got back was most commonly 'Gating Drums'. Yes, a fairly predictable answer. Then we looked at the existing products available to the Pro Audio Market. These were all either single, dual, or at the most four channel units.

Then we thought, take a look at your average Drum Kit. Does it come as a single, dual or four drum set? Not very often.. It comes as Kick Drum, Snare, a couple of mounted Toms and at least one Floor tom. Add to that a High Hat and what have you got? Six instruments and six channels.

We then decided that our gates had to have enough channels to cover just about any application in the one unit, while occupying only one rack space. So we decided on six!

The Sixgate was born.

### Circuit description and basic functions

To interface with the rest of the Pro Audio world we've given the Sixgate balanced inputs and outputs on Tip Ring Sleeve jack connectors, allowing it to be easily interfaced with its most common application - as a channel insert for mixing consoles and balanced line level sources.

The control section of each channel is accessed via the Sidechain Insert/Key Input jack on the rear panel.

For the technically minded, the control section of each channel of the Sixgate consists of a variable gain input buffer, an AC/DC converter, comparator and LED indicator Stage. The Red LED indicates the gate is closed, the Green LED indicates the gate is open.

The variable gain buffer determines the gate's Threshold, the AC/DC converter converts the audio signal to a DC control signal, the comparator provides the variable gate release time control signal for the gain control element, and the LED indicator stage provides the visual indication of operating status.

The attack time of the Sixgate is Program dependent. If the signal being gated is transient (sharp attack) in nature, then the gate opens really fast; if the increase in signal is slower, then the gate opens slightly slower, minimizing interference with the dynamics of the signal being gated.

The audio signal control stages consist of the balanced input stage to minimize hum and RF pickup in the input cabling. The gain control element and variable attenuation stage then feed the balanced Output stage. The gate In/Out switch lets the audio signal completely bypass all electronic circuitry.

We've housed the complete unit in an all steel chassis to minimize dreaded hum pick up from other units (not really wanting to build something to reduce noise that introduces more of it!) with an attractive extruded aluminium front panel. It also has its own built in High Headroom power supply.

The power transformer has an expensive all copper shield to prevent EMI (Electro Magnetic Interference) getting into the audio circuits. We don't want you powering your Sixgate from a Battery Adapter through a plug barely suitable for your transistor radio. No wall warts here - this is a serious piece of Professional Audio Equipment, not an FX foot pedal.

### Gating Drums

As people told us, the most common application for gates is gating drumkits and other percussion instruments. The aim here is two fold:

1. To minimize or prevent leakage from other drums, cymbals and/or stage sound leaking into the desired channel (who wants Lead Guitar in the Floor Tom Channel?)and
2. To control (i.e. tighten up) the decay time of the drum or instrument in question.



In this application the Depth is normally set at Max (-40dB) to ensure the On to Off reduction is as great as possible. The Release time can be varied between Min, which is useful for snare drums (to quickly chop off the decaying sound), and Max which is useful for toms (to ensure drum decay sounds overtones etc. are heard and then signal is gated off). The Threshold is variable due to its dependence on the signal level being gated.

**A note of caution.** Setting too high a Threshold can chop off input transients or chop up the signal, especially on short release times. The best way to set the threshold is to start in the Min (-40dB) position and increase the threshold until the desired gating effect is obtained. This way you will ensure you have the gating effect that you want, without losing any of the drum's natural sound.

### Gating instruments

Gating instruments can be very useful for reducing hum, buzz, hiss and other extraneous noises you'd rather not have on your keyboard, bass or guitar channels.



For this application use a Depth setting between Max (-40dB) and half way (-20dB), and a Release fast enough so you don't get a hangover of the noises you're trying to gate out, but not so fast that the gate chops off the end of the notes. You want the gate to close as soon as the signal being gated decays away. Once again, as in all gating uses, the Threshold is dependent on the signal level.

### Gating Vocals

Have you ever noticed that your vocal frontline mics make great overheads? They pickup EVERYTHING (including conversations the band wouldn't want the crew to know about) as you can hear if you listen through the PFL's!

Gating vocals can be very handy in a live situation for reducing stage sounds, cymbal spill and generally cleaning up background vocals.

Gating the main lead vocal is not something we'd recommend for the inexperienced engineer. However if the lead vocal mic is only 2 metres (6 feet) from the Drum Kit (as is often the case), it can be very handy for removing cymbal spill. Use the low pass filter in the Sidechain insert to reduce the gate's sensitivity to higher frequencies (See the section on Sidechain Inserts) so that the gate doesn't open every time your drummer hits the crash cymbal. This method of operation is also very helpful for that curse of the Audio Engineer's life - the SINGING DRUMMER.

You can also clean up backing vocals by assigning all of them to a single subgroup, and inserting a gate on that group. Now you can have the backing vocal faders up all the time to catch them when they DO sing, but you won't pick up all the stage sound through those wide open mics when they DON'T sing.

If you want to experiment, you could also get background vocals to punch in just when you need them by triggering the backing vocal gates with the Lead Vocal Channel through the Sidechain Insert. (See the section on Key Inputs). This way the backing vocals come through ONLY when the Lead Vocalist is singing. With a long release time the backing vocal will hold on (stay open) and then decay away. Very tasteful. With Vocals we suggest a short to medium release time so that the gate doesn't produce the effect of the modulated cymbal mic - i.e. Every time the Vocal mic opens, the cymbals come up dramatically in the mix and die away with the vocal gate release. It sounds like waves at the seaside, but about 100dB louder!



A Depth setting of around 10dB will ensure that the vocals don't leap out from nowhere. The Threshold once again depends on the signal level through the mixing console.

Gating can also reduce the possibility of feedback, by reducing the number of microphones that are open at any one time. However, make sure that you don't get lulled into a false sense of security, and have your gain controls and fader levels set too high. When the gate opens, the channel is going to be just as susceptible to feedback as an ungated channel. If you have 3 or 4 vocal channels with high gain all open at once, the possibilities of feedback are very high, and it can be very embarrassing if they all decide to open at once.

#### Gated Reverb Drum Sound

Apart from gating dry drums (no effects added), the next most popular use for gates with drum kits is controlling the decay envelopes of reverb applied as an effect to the Snare and Toms.

Although there are a lot of Digital Reverbs now available with this type of sound as a preset, there are also a lot of older R1000 type units still in use out there that offer minimal controls, apart from fairly basic Room presets. You may not want to tie up an AMS on the Snare drum!

Like most great ideas, its beauty lies in its simplicity. By patching a gate to the output of the reverb you can now control the decay character of both the drum and the reverb being added to it. A short release time will chop the reverb off very quickly while a medium release will allow the reverb sound to come through with the decay of the drum before they are both chopped off together.



The setting here for the Release control should be whatever is required to achieve the desired effect - experiment till you get the sound that you're looking for. The Depth should be on maximum (-40dB) and the threshold as always is dependent on the signal level through the mixing console.

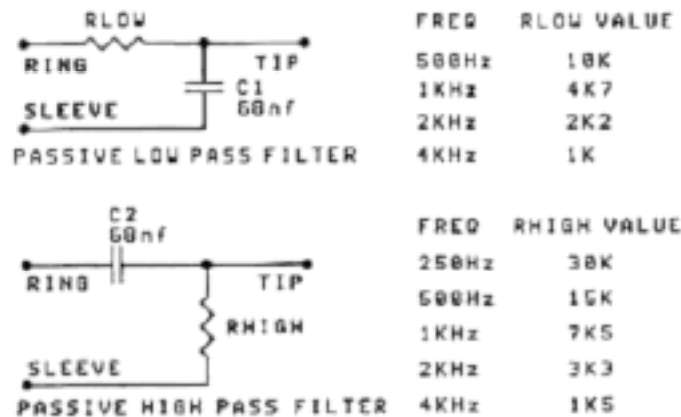
#### Sidechain Inserts and Frequency Sensitive Gating

The Sidechain Insert/ Key Input allows you to manipulate the Audio Signal being applied to the control circuitry of the Noise Gate. This socket accesses the audio signal after the input stage, but before the threshold variable gain buffer, and therefore is Audio not a DC control voltage.

Using this socket as a Sidechain Insert loop allows you to introduce filters or equalizers to modify the frequency sensitivity of the control circuitry.

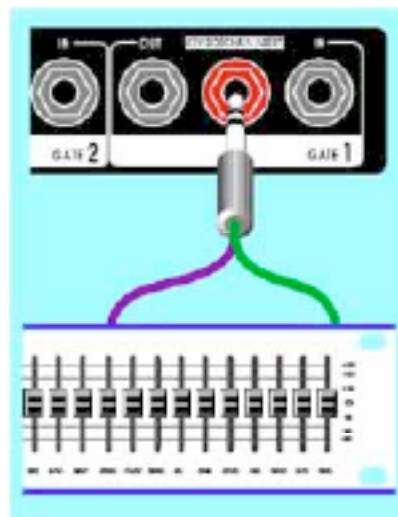
The simplest way of making the Sixgate frequency selective is to insert passive Low or High Pass filters in the loop. A Low Pass filter allows lower frequencies to flow unopposed through into the control circuitry while reducing in level (attenuating) the higher frequencies. This is handy for preventing cymbal splashes or the High Hat (both basically high frequency audio sources) from falsely opening the snare or tom channels (both basically low/mid frequency audio sources).

Alternately we can insert a High Pass filter in the loop. A High Pass filter allows higher frequencies to pass through unopposed while reducing in level (attenuating) the lower frequencies. This is handy for stopping drums or Bass Guitar amps falsely triggering cymbal or high hat channels.



Schematic of low and high pass filters, plus component values

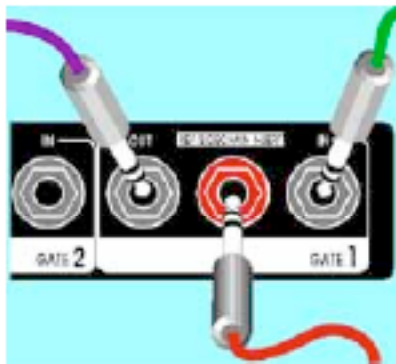
You can also insert a Graphic or Parametric Equalizer into the Sidechain insert to make the Sixgate more or less sensitive to specific frequencies. Boosting or increasing the signal level in a specific frequency band makes the Sixgate more sensitive to that frequency. Cutting or decreasing the signal level makes it less sensitive to that specific frequency band.



Remember that altering the frequency response in the Sidechain Insert loop has no effect on the frequency response of the signal being gated.

### Key Inputs

When you plug a signal into the Key Input of a Sixgate channel, that channel is no longer controlled by the signal plugged into the IN socket, but by the signal you have plugged into the Key Input socket.



As we mentioned above, it's handy for signal control like opening your backing vocals only when the main singer is singing. You can also have instruments like the Kick drum keying the Bass guitar channel to tie the bottom end rhythm section tightly together. Or to tighten up a ragged brass section by using the lead player to key the rest.

### The Kick Drum from Hell

We've saved one of the best uses of gating until last. Have you ever wondered how you can get a gut thumping kick drum sound from the cardboard box that your drummer calls a kick drum? Here's the secret.

1. Patch your Kick Drum channel through your Sixgate as usual.
  2. Take an audio Signal Generator, set it to Sine Wave output, dial up a signal around 40-60 Hz and plug that into a spare Sixgate Input.
  3. Take a Line Out signal from the Kick drum channel and feed it into the Signal Generator gate as a key input.
  4. Take the output of the Signal Generator gate and patch it into the Line In on the channel next to the Kick drum on your mixing console (once again only for neatness, any channel will work just as well).
  5. Set the release time of the Signal Generator gate to the same as the Kick drum gate, and set both Depth controls to 40dB (Max)
  6. Get the drummer to hit the Kick drum while you set the Signal Generator gate Threshold so that its LED indicators are flashing about the same rate as the Kick Drum gate LEDs.
  7. VERY VERY slowly bring up the level of the Signal Generator channel on your mixing console until you have the amount of Low Frequency energy you want. You can alter the output frequency of the Signal Generator until you get exactly the Kick Drum sound you're after.
- If you're really adventurous you can try exactly the same thing we've described above with the snare drum, using the Pink Noise output from your Spectrum Analyzer instead of the Signal Generator.



One final thing to remember - if you think the Sixgate is great on drums out front, then you should see what a difference it makes on drums in the monitors!