ABSOLUTE PHASE IN AUDIO GEAR

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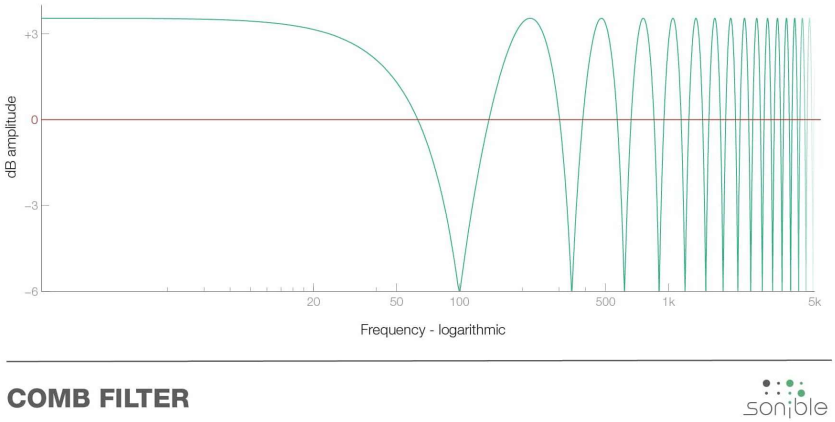
In any piece of audio gear that does not have variable phase shift it is important that all inputs and outputs to be in phase. This includes intermediate looping sends and returns. This is important because if signals reaching the speakers are unintentionally out of phase with other parts of the signal off cancellations and reinforcements may occur.

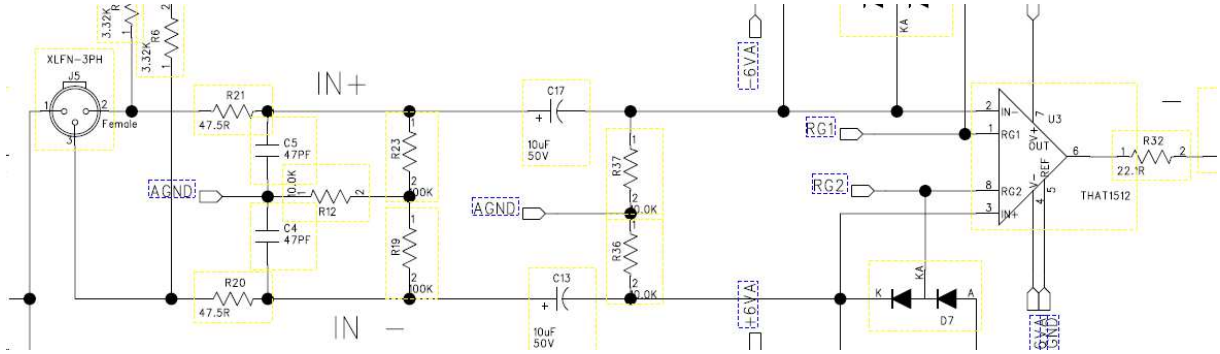
Sometimes one gets a comb filter effect in the frequency response such as shown to the right.



This is critical even in intermediate loops. Because the output is sometimes used as a tap for some intermediate use. While the return may be used as an input when a user only wants to use part of the product. It cannot be assumed that loops will only be used as intended.

To keep track of the phase through a product, the writer puts "+" and "-" signs along connections in the schematic.

Using the microphone input of the Voco Loco as an example, on the XLR input pin 2 is always considered the + phase and pin 3 is the - phase.

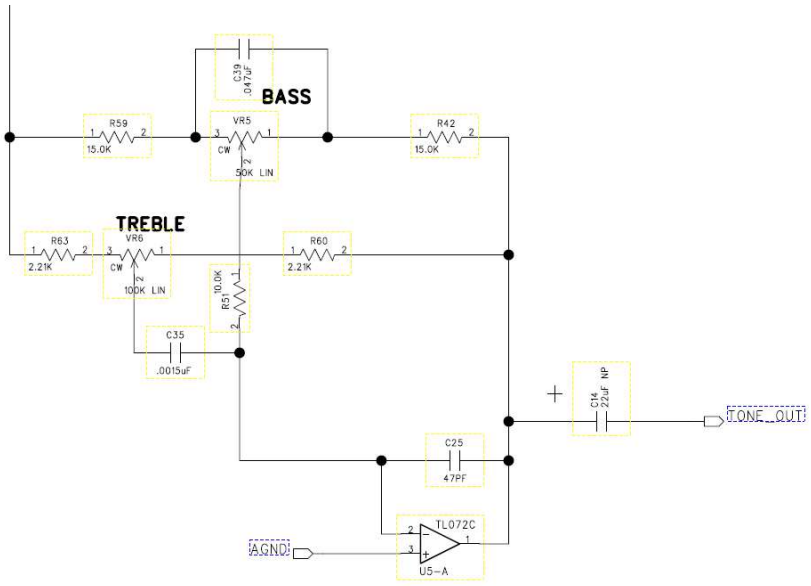


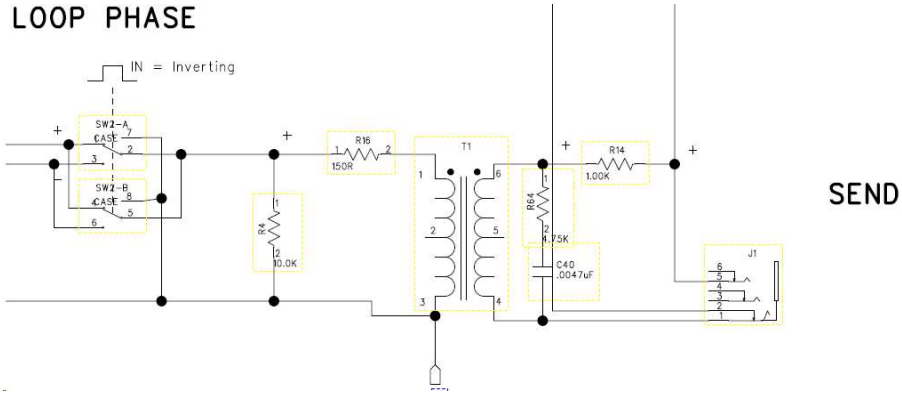
It can be seen the Pin 2 input is feeding the IN- pin on U3 which results in inverted phase on the output indicated by - sign. The reason for this inversion was that it was found that when the entire product was designed with the + in feeding IN+ the loop send was out of phase. Swapping the inputs of U3 was the easiest thing to do to bring the loop send int phase. It must be noted that U3 is a

special microphone pre-amp chip and not a standard opamp.
This use of the +/- symbols made it easy to predict the phase.

In doing this sort of thing we try not to say the - phase in 180 degrees out of phase. That is because this describes a time delay. In this case the peak of the - phase is occurring at exactly the same time as the + phase. Except that the signal is inverted. So we just say we have an in phase signal or an inverted signal.

The following stage is a standard Baxandal tone control with bas and treble controls. Though in pro audio we avoid such consumer grade terms and refer to these as LF and HF EQ. It is to be noted that the signal enters into the CW (clockwise) ends of the controls. The wipers connect to the - inputs of the opamp which means this is an inverting circuit. Because the signal entering from the previous circuit was inverted, this inverting circuit puts the signal back into phase as indicated with a + sign in the TONE_OUT line.



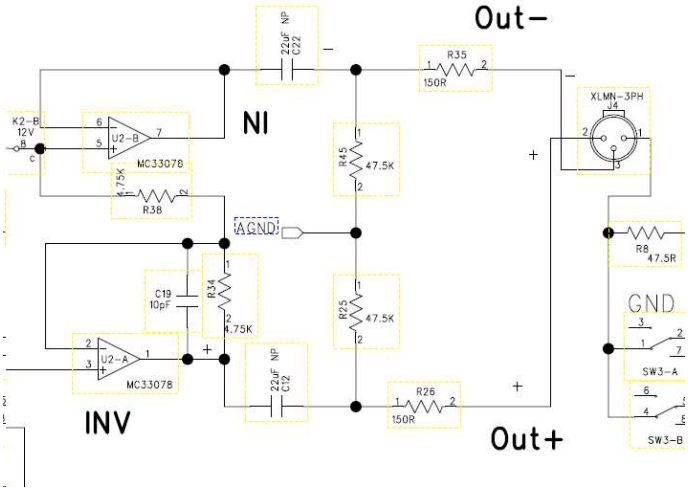


SEND

Here in the effects send circuit we always show the switches in the OUT position. In this case for a phase switch it is the position where the signal stays in phase Thus there are + signs on both sides.

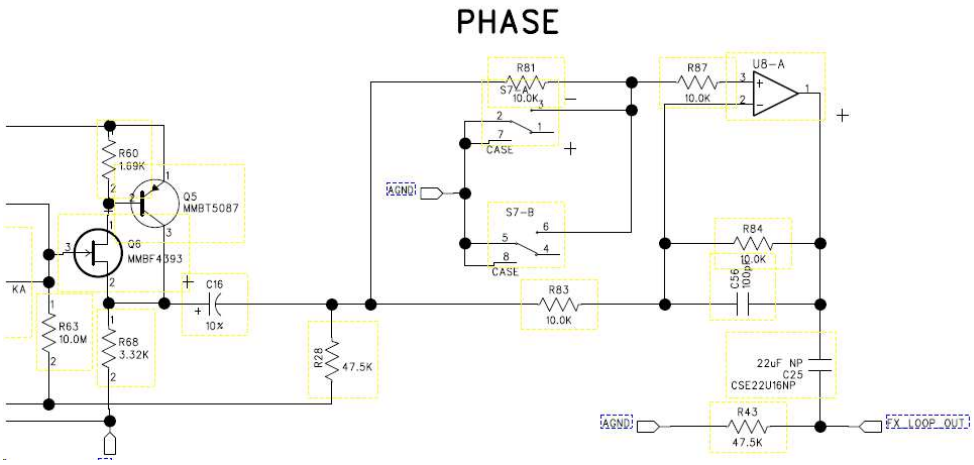
On the transformer there is a dot at one end of each winding's symbol. If the dots are aligned, the phase will stay the same. Thus by feeding a + phase signal into pit 1 with the dot and we make the pin with the dot on the secondary is the "hot" lead, phase will be maintained through the transformer. Or if pins 4 and 5 were reversed then the output signal would be of inverted phase. But here we wanted phase to be maintained. These dots or some other indication may or may not be on the actual transformer.

On the output stage you would normally expect the + phase to come out to the upper device and the - to the lower. However it did not turn out that way. While a phase inverting stage could have been placed ahead of the output, this adds extra cost, noise and distortion. So in this case pins 2 and 3 were merely swapped to bring things back in phase. Pin2 to always be the + phase output on a balanced line. The criss crossing of the lines seems clumsy but it does not hurt anything.



Therefore, go through the schematic of the Voco Loco and other products to see how the phase was marked on lines and what sort of circuits invert and do not invert the signal.

Here is a handy circuit that is in the Bassbone OVD.



Normally 2 op amps are used to have an in phase and out of phase signal to chose from in making a phase inversion switch. In this circuit when the phase switch is in the rest position, when open the phase of the output is in phase with the input. This is indicated with the + sign on that pin of the switch. When the switch is closed, the opamp becomes a phase inverter as indicated on the activated position with a - symbol. The two gangs of the switch are in parallel merely because we had a spare gang on the switch because with both in parallel the switch will last longer before it becomes noisy from corrosion. It is best if all 4 resistors are the same value and 1% tolerance. The 47.5K resistor is there just to give a ground path for the bias currents of the op amp inputs and to set a ground reference.