

Howdy!

I often receive requests for a single magnetic pickup which will be installed in an instrument with one or more other magnetic pickups. Making sure that the new pickup will compliment the other pickups is the subject of this newsletter. If you only play instruments with one single coil pickup (or a humbucking pickup without coil tap capability) matching pickups will not matter to you; for the rest of us it matters a great deal. For a new pickup to function well along side other pickups it should have the correct tone, volume and phase orientation (more on this later).

Why would you care about matching a new pickup with an existing pickup?

Instruments with more than one pickup often have some method for selecting which pickup or combination of pickups are operational at any given time. One or more pickup selector switches or blend pots can fulfill this function. When two pickups are operated simultaneously (the middle pickup selector switch position in a Les Paul style instrument or a tele style instrument or switch positions 2 and 4 in a strat style instrument) the pickups are usually operated in parallel. The signals from these two pickups can either be in phase (for a strong, clear signal which is usually the desired result) or out of phase (resulting in a lower output signal). Custom switching configurations can also offer series combinations of pickups. In either case, the combination of magnetic field direction and winding direction of each pickup will determine the phase orientation of the signal generated by the pickup. In many modern instruments the pickups are designed such that when two pickups are operated simultaneously (switch positions 2 and 4 in a strat style instrument for example) the signals from these two pickups are in phase. This phase orientation is often accomplished by making the pickups such that the coils are reverse wound with respect to each other and the magnetic fields are opposite of each other. Reverse wound, reverse polarity is often abbreviated as RWRP. Given that there are two possibilities for phase orientation (in phase or out of phase) if a new pickup was purchased to match an existing pickup with no consideration of the winding direction or phase orientation, the probability that these two pickups when operated together would be in phase is 50%.

Tech stuff:

1. *Magnetic field direction.* Imagine a simple straight bar magnet; one end (usually painted red) is the north pole and the other (often painted white) is the south pole. The earth is also generally considered to have two magnetic poles; one north and one south. As is the case with many seemingly straight-forward concepts, once one explores more deeply hidden complexity becomes revealed. At first one would think that the north pole of the earth is a standard reference point one could use to define the magnetic polarity of any other permanent magnet. There are at least two schools of thought on the magnetic field orientation of the earth's
 - a. A "person on the street" would likely say that the magnetic orientation of the earth's magnetic north pole is north.
 - b. Scientists however assign a south magnetic polarity to the earth's north pole; for a full discussion of this topic please go to: http://en.wikipedia.org/wiki/Magnetic_north_pole

Ok, so there is some lack of consensus in the definition of the magnetic north pole. One way around this confusion is to use a standardized instrument designed to correctly determine magnetic polarity: a compass. If you have a tele style instrument and wish to purchase a new neck position pickup to go along with an existing bridge position single coil pickup you can use a compass to determine the polarity of the bridge position pickup. By holding the compass close (within ~ 1/4") to the top of the bridge position pickup you will observe that either the red end of the compass needle is attracted to the top of the pickup or the white end of the compass needle is attracted to the top of the pickup. Let's assume the red end of the compass needle is attracted to the top of the bridge position pickup; this would indicate that a new neck position pickup which attracts the white end of the compass needle should be purchased if the two pickups are to have opposite magnetic polarity. I use the layman's definition of magnetic polarity: if the top of a pickup attracts the red end of a compass needle (as does the earth's magnetic north pole) I call this pickup north up.

2. *Winding direction.* One would think that winding direction would be less ambiguous than magnetic field direction, after all, there is only clockwise and counter clockwise, right? Well, once again, there is room for confusion. The definition of clockwise and counter-clockwise depends upon the viewpoint or the observer relative to the object being viewed. If two people were on opposite sides of a transparent clock (one with a non-transparent second hand) the person facing this clock in the usual manner would observe the second hand sweeping in a clockwise direction, the other person behind the clock facing the clock's back side would see the second hand moving counter clockwise.

I define the winding direction of pickups I make based on looking down onto the top of the pickup bobbin.

For single coil pickups which have no grounded shielding you can reverse the effective winding direction of the pickup by reversing the assignment of the two output leads. Many single coil pickups have two output leads; often one of these leads has black electrical insulation (the conductor of this output lead is usually intended to be soldered to a ground location) and the other output lead (often with white or red colored insulation) is used as the "Hot" output which is soldered to a volume control pot or pickup selector switch. In this example the effective winding direction (whatever it is) can be reversed by soldering the lead with white or red colored insulation to an electrical ground in the instrument and using the lead with black insulation as the "Hot" output.

Some single coil pickups (such as standard tele style neck position pickups) have a grounded shield (the metal cover) which is also soldered to the ground output lead. To reverse the effective winding direction of this kind of pickup one would need to do the steps described immediately above **and** break the electrical connection between the original ground lead (usually the output lead with black insulation) and make a new electrical connection to the new ground lead (white or red insulation) or install a new independent insulated ground lead from the metal pickup cover to a good electrical ground location (such as the back of a volume or tone pot).

In summary:

If you plan to add a new pickup to an instrument with one or more existing pickups I suggest the following:

1. Share with the manufacturer of the new pickup you plan to purchase as much information as you have about the pickups the new pickup will be paired with (specifically magnetic field direction and winding direction if known).
2. Purchase new pickups that are designed to allow you to reverse the effective winding direction if needed (unshielded pickups with two independent output leads or shielded pickups with an independent ground lead).
3. Consider a pickup design which would allow you to reverse the magnetic field direction by removing the magnets and re-installing the magnets with the magnetic field direction reversed.

My congratulations to all of you who have read all the way through this newsletter!

I hope this information is helpful to you.

Best Wishes.

If you do not wish to receive "Tech Tips", please respond with "Unsubscribe". Thanks!