

### **Sensor construction and proper orientation.**

The 856 proton precession sensor coils are binocular (one glued above the other, coil axis horizontal in normal vertical mounting) and wired in series opposed like a humbucking pickup in a guitar. The North Arrow is at right angles to the axes of the coils, so that when the arrow is pointed North, the coil axis is East-West. This is the proper orientation because using the electromagnetic polarizing field of the coils we want to pull the alignment of the protons (normally aligned North-South with the earth's field) to the East-West and then let them go. As they return to N-S they precess like tops because they are spinning and hence we have proton precession.

When the earth's field vector is lined up with the axis of the coils, i.e., right down the barrel, we don't get any signal because the protons are already lined up with the earth's field vector. So we have to pull them off alignment using the coils to get a signal. The same coils that reorient the protons also are used as pickup coils to sense the precession of the protons. The coils are humbucking to buck out the 50/60Hz AC hum. If you mount the sensor vertically on the end of the staff and point the arrow North then the coils are at right angles to the earth's field no matter where you are! If you are at the North Pole and the field is vertical then the coil axes are still E-W and you get max signal. If you are at the equator and the earth's field vector is horizontal and pointing N-S then the coil axis is E-W and you get maximum signal. So no matter where you are, if you have the sensor mounted vertically and point the arrow North you will get maximum signal. We put the side mount on the sensor so that if you are at a field inclination angle (field dip angle) of less than 45 degrees then mounting the sensor on its side (now the coil axis is straight up-down), you will get good signal. If you are at the equator and the field vector is horizontal, you will get maximum signal no matter which way the sensor is rotated.

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